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## TABLE OF CONTENTS.

ENGINEERING NEWS OF THE WEEK..... 369
The Sioux City Bridge (Illustrated)..... 370
Laying the 42-in. Steel Conduit for the Jersey City Temporary Water Supply..... 370
Water Power; Its Generation and Transmission.. 370
The Ellicott Square Building, Buffalo, N. Y. (Illustrated) ..... 372
Submerged Cast Iron Pipe Intake for the Water-Works of Erie, Pa. (Illustrated)..... 373
The Reliability of Throttling Calorimeters..... 374
Tests of a 10-HP. De Laval Steam Turbine..... 374
Fuel Saving in a Large Oil Refinery..... 375
Longitudinal Angle Stiffeners for Plate Girder Chords (Illustrated) ..... 375
Comparison of Forced and Induced Draft for Steam Boilers..... 375
A Few Days in Connecticut (Editorial Correspondence) ..... 379
Express Locomotive for the Chicago, Burlington & Quincy R. R. (with inset, Illustrated)..... 381
A Model Electric Lighting Franchise for Montclair, N. J. ..... 382
A Simple Electric-Locking Circuit for Interlocked Crossings (Illustrated) ..... 383
Tests of Fireproof Flooring Materials..... 384
Annual Meeting of the American Society of Mechanical Engineers ..... 384
EDITORIAL NOTES .....376, 377
The Lesson of the Preble Train Wreck—A "Sun" View of Civil Engineering—The Effect of Grades on High Train Speeds—The Qualifications for a City Engineer—A Model Electric Lighting Franchise—A Chicago Ordinance to Secure Good Paving—The Use of Low Test Oil on the Manhattan Elevated R. R.
EDITORIAL.
The Cost of Hauling Freight on Common Roads.. 377
LETTERS TO THE EDITOR..... 378
Speed of the U. S. Cruiser "Minneapolis"—Notes and Queries.

A second trial of storage-battery traction on the Fourth Ave. street railway in New York city is now being made. Several years ago this road ran cars equipped with the Julien batteries, and the experiment was not entirely unsuccessful, the cost of operation being found to compare unfavorably with that of horse traction. Certain changes were found to be desirable, however, in the design of the car and in the method of handling the cells. In the Julien system, and, in fact, in practically all storage-battery street car systems thus far tried, the batteries were placed in trays under the seats, necessitating wide seats and a narrow aisle. These trays were removed through the ends of the cars. In the two new cars now running on Madison Ave. a tray containing 60 chloride cells is suspended on the truck frame, between the two axles, and entirely independent of the car body. The method of loading the tray onto the car is as follows: The car is run into the shop on tracks extending over a long pit. The tray containing the charged accumulators is run onto an elevator directly under the car, and is thereby hoisted into its proper position in the truck frame. The process is automatic, except that the charged and uncharged cells are pushed to and fro along the pit by manual power. The total capacity of the 60 cells is 400 ampere-hours. The total weight is 5,700 lbs., but in the series of tests about to be undertaken, a lighter form of battery, weighing 2,400 lbs., will be tried.

The motor carriage competition for prizes offered by the "Times-Herald," of Chicago, took place on Nov. 28, but only six carriages took part, although a large number had been entered. Gasoline motors were used on the carriages of the Duryea Motor Wagon Co., of Springfield, Mass.; H. Mueller & Co., of Decatur, Ill.; Macy & Co., of New York, and the De La Vergne Refrigerating Machine Co., of New York. Electric motors and storage batteries were used on the carriages of Morris & Salom, of Philadelphia, Pa., and the Sturges Electric Motocycle Co., of Chicago. The trip was from Jackson Park to Evanston and back, a distance of 54 miles, and the roads were covered with snow, slush and mud. The Duryea carriage arrived first, having made the trip in 7 hours 53 minutes, and the Mueller carriage in a little over 8 hours, the former averaging 7½ miles per hour of its running time. The Mueller carriage made about 10 miles an hour in a run on Nov. 2, under more favorable conditions. The Sturges carriage did not complete the trip. The De La Vergne carriage did not run far, the wheels slipping in the snow. The Morris & Salom carriage ran about twelve miles, changing batteries twice, and was then withdrawn on account of the depth of snow on the road. The Macy machine (fitted with a Rogers motor) had a collision with a cab on the return trip, by which its steering gear was damaged, and eventually it had to stop. We expect to give further particulars of these motor carriages in a later issue.

The French motor carriages now coming into such extensive use, says Consul C. W. Chancellor, of Havre, include both bicycles and tricycles propelled by a small petroleum motor. The weight of the entire machine is considerably under 100 lbs., and the price is about $250. On mounting, the rider turns a tap, which admits the petroleum, and at the same time ignites it by an electric spark. The cycle is propelled by the feet, in the usual manner, until the motor is working; the movement of a lever then disconnects the treadles, and leaves the motor to do the work. On ascending grades, the feet may assist the motor. A somewhat similar machine, carrying two persons, is also being made. For heavier loads, what is called "a steam horse" is used, either joined to a carriage or forming an integral part of it. In these a small tubular boiler, with coke as fuel, furnishes steam to an engine. A victoria carrying four persons will weigh about 1,500 lbs., and the cost varies from $1,800 to $2,500, according to size and type of vehicle. Petroleum engines are also used on many of these larger carriages.

Forty compound locomotives for the Russian Government railways are now being built by the Baldwin Locomotive Works, of Philadelphia, Pa. They are all Vauclain four-cylinder compounds, 20 of them being consolidation freight engines and 20 being ten-wheel passenger engines. They are built to the builders' designs, and closely resemble engines on American roads, but have certain fittings, in accordance with the standard requirements of the Russian railway authorities, among which may be noted a heavy hand-railing on the outer edge of the running board, extending the whole length of the boiler. The engines have no pilots, but have spring buffers on the bumper beam and a vertical bar or "knife" extending from the bumper beam down to near the rail to knock off stones or other obstructions. The engines are erected at the works, and are then taken apart for shipment.

The eccentric Holman locomotive, whose driving wheels rest on truck wheels, and are claimed to in some mysterious way thus develop greater power and speed, has been run experimentally on the South Jersey R. R., attaining a speed of 25 miles per hour.

Oil fuel is to be tried on the locomotives of the San Bernardino, Arrow Head & Waterman Ry., of California, which road has recently been sold to F. Kohl, of Centralia, Ill.

The average running speed of the Empire State express, between New York and Buffalo, on the New York Central R. R., has been accelerated from 51 to 53⅓ miles per hour, its time having been cut down by 25 minutes, or to 8 h. 15 min. for the 440 miles.

The new "overland express" of the Union Pacific Ry. has a schedule time 12 hours shorter than the former schedule both to San Francisco and Los Angeles, the time to the former place being now 74¼ hours for the run of 2,355 miles from Chicago, or at an average speed of about 32 miles per hour, including all stops and the slow running in crossing the Rocky Mountain divisions.

English steel rails have been purchased by a California railway, the cost of rails and freight by sea being less than the cost of American rails and freight by railway. English rails cost about $23 per ton at New York or other Atlantic ports, and the duty brings this up to about $30, the duty being $7.84 per ton, and then comes the cost of transportation. Sailing ships from England, however will carry the rails to Pacific ports at low rates, as there is little cargo to be obtained for the outward voyage. The order is for 10,000 tons, and was obtained by Griswold & Gillett, of New York, agents for the firm of Cammell & Co., of Sheffield.

The operation by electricity of the Illinois Central R. R. suburban trains in and around Chicago is being seriously considered by the officials of that company. According to Chief Engineer J. F. Wallace, M. Am. Soc. C. E., the company is now making extensive investigations to determine the fitness of electric power for its suburban train service, and should these investigations be favorable, a trial will be made in actual service. The success of these service trials will determine whether or not the electric system will be generally and permanently adopted for the surburban lines of the company.

The most serious railway accident of the week was a side-track collision on the Delaware, Lackawanna & Western R. R., at Preble, N. Y., Dec. 1, caused by a switch which had been forced open by train wreckers. The train was a southbound express for New York and Philadelphia, and consisted of a baggage car, mail car, two day cars and a sleeping car. It was running at high speed, when it was turned onto the side track and collided with some freight cars. The engineman and fireman of the express were killed. The engine and baggage car were upset and smashed, and the wreck of the latter caught fire, it is said from the lamps, four of the cars being destroyed. None of the passengers were injured.

The breaking of an axle on a mine car in one of the Cambria Iron Co.'s mines at Johnstown, Pa., caused a wreck of four or five cars, hauled by cable, in which a gang of miners was returning to the surface. Twelve men were seriously injured, one fatally.

The caving in of a trench for a house connection to a sewer, at Oakland, Cal., on Nov. 21, causing the death of the contractor, Fred. Weilder.

A terrible accident, in which about 12 men were killed, occurred Nov. 29 in the Tilly Foster iron mine, near Brewster's, N. Y. This mine is an open excavation about 600 × 400 ft., and in some places 400 ft. deep. About 30 men were at work on the lower level when a great mass of rock fell in from the north end of the pit. Great difficulty was met with in getting out the dead and injured, owing to frequent fall of rocks, caused by the recent heavy rains and freezing weather. The mine is owned by the Lackawanna Iron & Coal Co., of Scranton, Pa., and Clinton Stephens is the contractor for the excavation.

The boiler of the Ohio River towboat "W. W. O'Neil" exploded Nov. 26, while the boat was lying at the wharf at Cincinnati, O. Three men were injured.

An ordinance to prevent collusion with intent to defraud between the contractors for street paving and the inspectors employed by the city has been introduced into the City Council of Chicago, Ill. As drawn the first clause of this ordinance provides that a provision shall be inserted in all contracts and specifications for street improvements which shall require that before the final estimate is issued and final payment made on such contract, the contractor shall deliver to the Commissioner of Public Works his sworn written statement of the amount, kind, and quality of the several materials required, that were delivered upon and incorporated into the work, by whom the same was furnished to said contractor; also the team tickets, freight receipts, etc., showing delivery, together with a statement in writing under oath of the party or parties furnishing such materials to the contractor, setting forth the kind, quality, and quantity of all materials furnished by them respectively, and delivered upon and incorporated in the work, and no final estimate nor final payment shall be made by the city or any of its officers until such sworn statements shall have been furnished, as aforesaid, and verified by the Department of Public Works through the reports of its inspectors or otherwise. The second clause provides that any contractor entering false statements shall be debarred from again bidding on work or furnishing material for work. The third clause provides that the inspector shall keep records of material received and used by the contractor and report the same to the Commissioner of Public Works. The fourth clause provides that nothing in the ordinance shall be deemed to restrict or abridge the right of the city to tear up the work to determine whether it has been done according to contract or not. We have briefly discussed this ordinance on our editorial page.

Two sets of lift-locks, for Lockport, N. Y., are being designed by the Buffalo Engineering Co., under orders from State Engineer C. W. Adams. The two sets of locks will have two distinct plants for operation. Each lock is to be 225 ft. long, 20 ft. wide and 10 ft. deep, capable of holding two boats. As briefly described in the Buffalo "Courier," the lock-tanks will be suspended and operated by steel wire cables, with counterweights, and the locks and accompanying plant will cost about $500,000. These two sets of locks would supplant the five present locks at Lockport, with an aggregate lift of 54.4 ft. Mr. C. M. Morse and Mr. F. M. Sylvester, of Buffalo, N. Y., will have charge of the proposed work, the general scheme of which was illustrated and described in our issue of April 18, 1895, from a paper by State Engineer Adams.

The reclaiming of 7,000 acres of swamp land from the Illinois River in Illinois is to be undertaken by Christie & Lowe, engineers and contractors, Chicago, Ill. According to the statement of Mr. Geo. B. Christie, there are about 300,000 acres of land in the Illinois River valley which is now valueless on account of its danger to flood and poor drainage, but which would become very valuable if once drained and protected from flood. The land purchased by Christie & Lowe is a part of this tract, and that firm proposes to reclaim and rent it. A levee will be built along the river bank to shut off the flood water, and a system of canals dug to properly drain off the rainfall. It may be that a centrifugal pumping plant will be necessary to empty the main canal into the river at times. It is stated that work will be pushed so that a portion of the land will be ready to rent next spring.

## THE SIOUX CITY BRIDGE.

This bridge crosses the Missouri River at Sioux City, Iowa, and carries the single track of the Pacific Short Line Ry., two roadways and two sidewalks. The structure consists of two 470-ft. drawspans and two 500-ft. fixed through spans of the general design shown in the illustration. The weight of the two drawspans is 3,000,000 lbs., and that of the fixed spans 4,400,000 lbs. The bridge was designed by Mr. J. A. L. Waddell, M. Am. Soc. C. E., and was built by the Phoenix Bridge Co., of Phoenixville, Pa., of which John Sterling Deans, M. Am. Soc. C. E., is Chief Engineer.

ERECTING THE NEW BRIDGE ACROSS THE MISSOURI RIVER AT SIOUX CITY, IA.
J. A. L. Waddell, M. Am. Soc. C. E., Chief Engineer. The Phoenix Bridge Co., Contractors.

The work of erection was started on the first drawspan on Sept. 8, 1895, and the second fixed span was connected on Oct. 28, including a total of about 1,500 ft. of bridge and 5,900,000 lbs. of metal. Including the erection of a complete set of falseworks, the two fixed 500-ft. spans were erected in 24 days from the time of setting the first piece of metal. Mr. A. B. Milliken, of Philadelphia, superintended the erection for the Phoenix Bridge Co.

The contract was signed on June 12, 1895, and the first metal work was shipped from Phoenixville on July 24, 1895; the erection was started on Sept. 8, as above stated, and the last pin in the last drawspan was driven on Nov. 18, 1895. The entire structure, including screens, railing, roadway and sidewalk floors, railway floor, track and painting, will be completed by Jan. 1, 1896, making an exceptionally rapid record of construction and erection. The contract was entered into with the Combination Bridge Co., of Sioux City, represented on the work by Mr. Lee Treadwell, Resident Engineer.

This bridge was originally contracted for in 1890, and about 25,000 lbs. of metalwork were ready for shipment and 600,000 lbs. rolled when the work was stopped, owing to financial difficulties, until the date above named.

## THE 42-IN. STEEL CONDUIT FOR THE JERSEY CITY TEMPORARY WATER SUPPLY.

Under its contract to furnish Jersey City with a temporary water supply, the East Jersey Water Co. is laying about 8,600 ft. of 42-in. riveted steel pipe from the Belleville receiving reservoir of the water-works of Newark through the town of Belleville to a connection with the supply mains leading across the meadows to Jersey City. The work involves the crossing of the Passaic River, which is effected by means of seven 16-in. wrought iron pipes laid in a trench dredged in the river bottom.

The 42-in. pipe will tap the 48-in. steel conduit which brings Pequannock water 21 miles to the receiving reservoir, mentioned above. The connection between the two mains will be made by means of seven short 16-in. pipes, laid at right angles to the large pipes. Cast iron flanges, riveted to the mains, will be used to make the connections. These flanges are so shaped as to give bell-shaped openings into the large pipes. Being of cast steel, they can be calked, as can all the joints in riveted steel conduits.

The 42-in. conduit is made from ¼, 5-16 and ⅜-in. plates rolled at Homestead by the Carnegie Steel Co. The longitudinal joints are double and the circular are single-riveted, with ⅝, ¾ and ⅞-in. rivets, made of steel for shop riveting, of wrought iron for field riveting. The circular joints are entered "stovepipe fashion"—that is, each section is made smaller at one end than at the other, and the small end of a section is inserted into the large end of the next, instead of making each section alternately large and small, as was done on the original Newark pipe line. By always placing the smallest end of the pipe section downstream, the water glides over instead of impinging upon the end of the inserted pipe, thus reducing friction. Mr. Clemens Herschel, M. Am. Soc. C. E., Chief Engineer of the East Jersey Water Co., states that in future work he shall seriously consider countersinking the rivets, in order to still further decrease friction.

The contractors for the 42-in. pipe line, Messrs. T. A. & R. G. Gillespie, of Pittsburg, Pa., are using a "Special Trench Steam Shovel,"* made by the Vulcan Iron Works, of Toledo, O., for a part of the rough trenching. They are also using pneumatic hammer riveters and calkers, the compressor plant being located but twice on one side and once on the other side of the river, the air being piped where needed.

The river crossing is about 400 ft. between dock lines, but the trench was dredged on each side of the river nearly to the respective street lines, which are about 500 ft. apart. At each side of the crossing the main conduit is brought down parallel to the river and tapped with the 16-in. pipe at right angles, as at the reservoir. This method of connection obviates the necessity of special castings or special riveted work. The smallness of the connecting pipes also makes it an easy matter for one man to handle the gates, an important matter in localities where it is desirable to station only one man.

Gates will be placed on all of the 16-in. pipes at each side of the river, and there will be a 42-in. Venturi meter on the main conduit at the east side to measure and automatically register the supply to Jersey City, which is to be paid for by the million gallons.

The 16-in. river pipes were put together in 150 to 200-ft. sections on the east shore, and then hauled across the river by cables wound on the drum of a hoisting engine on the opposite side of the river. As soon as the first section was ready it was hauled out into the stream, after which the next section was attached and pulled out, and so on. Cast iron sleeves, calked with lead, were used at the joints, and no flexible joints were provided, although there is a considerable change in grade at each side of the river.

A little difficulty was experienced in getting the first pipe across, but profiting by the lessons learned, the balance of the work was accomplished with so much ease that Mr. Herschel states that if he had the work to do over again he would carry the 42-in. pipe across, instead of dividing it into smaller ones.

* Illustrated and described in Engineering News, Sept. 5, 1895.

The original 48 and 36-in. steel conduits built by the East Jersey Water Co. for the supply of Newark were described in Engineering News of Aug. 1 and 8, 1891, and July 13, 1893. In our issues of June 15, 1893, and Dec. 13, 1894, an account was given of a 54-in. submerged steel intake at Syracuse, N. Y., and on April 11, 1895, we described a 38-in. steel conduit 26½ miles long and a 60-in. submerged main 1,600 ft. long for the water supply of Rochester, N. Y., and in our issue of Oct. 10, 1895, a 60-in. steel force main, 10 miles in length, built for Allegheny, Pa., this year. The contractors for the work described above, T. A. & R. G. Gillespie, of Pittsburg, constructed the Newark and Allegheny steel-pipe lines just mentioned.

The Passaic River crossing work has been done by the East Jersey Water Co. with its own force of employees. Mr. J. Waldo Smith, Assoc. M. Am. Soc. C. E., is First Assistant Engineer of the East Jersey Water Co., and Mr. F. J. Gubelman, Assoc. M. Soc. C. E., is Assistant Engineer. We are indebted to Mr. Herschel for the above information.

## WATER POWER—ITS GENERATION AND TRANSMISSION.*

By Samuel Webber, M. Am. Soc. M. E., Charlestown, N. H.

The engineers who have been for many years engaged in the question of water-supply for large cities have laid it down as an established fact that, by means of proper and complete storage basins, one-half the annual rainfall may be thus saved, the other half being either absorbed by vegetation or dissipated by evaporation. This amount has been usually estimated for our Northern cities as 1,000,000 gallons per day from each sq. mile of drainage area, or one-half an annual rainfall of 42 ins., which is a fair average for the larger part of the United States, east of Kansas and Nebraska, rising, according to Blodgett, as high as 50 and 55 ins., in parts of the Southwestern states, but a safe estimate for the area of drainages from the great Appalachian range, which is as wide an area as we propose to consider in this paper.

This annual rainfall of 42 ins. amounts to nearly 732,000,000 gallons on a sq. mile, so that 1,000,000 gallons per day is almost exactly half of it. To secure this half, however, requires the most complete and perfect system of storage basins possible, and it is not safe to calculate on such an amount as being available for water power by any possible and economical means of storage. It is possible, however, by practicable means of storage, to secure about one-third of the rainfall; and as the water for power purposes is usually measured in cu. ft. per minute, or per second, instead of gallons, we will now adopt that mode of computation.

An annual rainfall of 42 ins. is equal to 267,409 cu. ft. per day on a sq. mile, or 3.09 cu. ft. per second, and if we take one-third of this, or 1 cu. ft. per second, from each sq. mile of drainage area, we arrive at the supply which can usually, by the aid of storage, be relied upon.

The late James B. Francis once gave me the following data, as the result of many years' observation of the flow of the Merrimac River, which, however, does not take in the few days of "spring freshets," when the snow is going off from the mountains and the rivers so high and swollen as to be practically unmeasurable:

Spring flow.....= 90 cu. ft. per min. per sq. m.
"June flow," about average. 55 " " "
Min. flow in Aug. and Sept.. 30 " " "

The minimum flow has, however, been less than that once or twice in recent years, as, in 1881, it was only 26.7 cu. ft. per sq. mile drainage area, or 0.445 cu. ft. per second. This diminution has been due to the destruction of the forests around the head-waters of the river, and such forest destruction must be borne in mind by every engineer as a probability, when making estimates on a projected waterpower.

It will be seen that this 30 cu. ft. per minute, or 0.50 cu. ft. per second, the minimum flow, is but one-sixth of the rainfall, and in order to secure the one-third, which I have considered as available, a sufficient "pondage" must be secured above the dam, at the proposed water power, or in some other convenient location, to store the night flow, if the water is used in the daytime, or vice versa, so as to get a double quantity during working hours without too much diminution of the working head.

This is practically accomplished at Lowell, where the

* Abstract of a paper presented at the New York meeting of the American Society of Mechanical Engineers.

obervations on the water power of the Merrimac River have been longer continued, and are more complete than any others of which I am aware, by the pond made by the dam. This pond is 18 miles long, with an average width of 500 ft. The drainage area of the Merrimac, above Lowell, is 4,093 sq. miles, and if we take the minimum flow as 0.50 cu. ft. per second, we have a total flow of 2,000 cu. ft. per second.

Col. James Francis, who has succeeded his father as agent and engineer of the Locks & Canals Co., informs me that, with 3 ft. of "flashboards" on the dam, giving a fall of 34 ft., they can store in this pond, at a depth of 1.50 ft., 71,874,000 cu. ft. of water, which, if drawn down the 18 ins. in 10 hours, would give them 6,165 HP., which, added to the daily flow of the same 2,000 cu. ft., would give at low water a total of 12,330 HP. The original estimate of the power available at Lowell was 10,000 HP. on 30 ft. fall; but by raising the dam above, and removing obstructions below, this power has been increased, as shown.

The net effect of the present turbines in Lowell is here taken at 80%. There are, however, in place, at Lowell, turbines enough to utilize 20,000 HP., for which water is furnished for a portion of the year, but which have to be supplemented by steam engines, to supply the deficiency, when the water is reduced to the minimum flow, as above quoted.

In addition to this the mills at Lowell, Lawrence and Manchester, N. H., have also derived great benefit from the use of the water stored in Lakes Winnepesaukee and Winnesquam, in New Hampshire, where the outlets were deepened, and weirs and gates put in below, enabling the water-power companies to draw down these lakes in the summer to a depth of 12 ft. below the full height in spring, or 6 ft. below their normal summer level. The area of these lakes above the Lake Company's dam is 71.8 sq. miles, and Colonel Francis gives me the following data of the amount of water furnished by them for several consecutive years:

| Year. | HP. furnished for three months. | Depth drawn at lake |
|---|---|---|
| 1878 | 659 | 4.20 feet |
| 1879 | 809 | 5.16 " |
| 1880 | 1,299 | 8.28 " |
| 1881 | 1,600 | 10.20 " |
| 1882 | 1,308 | 9.60 " |
| 1883 | 282 | 1.80 " |
| 1884 | 1,845 | 11.76 " |
| 1885 | 69 | 0.44 " |
| 1886 | 1,067 | 6.80 " |
| 1887 | 0 | 0 " |

The variation in seasons is seen to be considerable.

Turbines.—The modern turbine is the evolution of ages from two distinct types, one of which delivers the water in a tangential direction to radial arms or vanes, projecting from a central shaft, without confining it in any way; the other conveyed it in a closed tube to hollow radial arms, through which it passed, and, leaving them in a tangential direction, gave, by the reaction pressure, a rotary motion to the whole apparatus.

We can trace both systems back to such remote antiquity that it is useless to attempt to find the origin; and as the principal developments of both have been made within the present century, we need go back no farther. As we shall devote much less time to the second of these types, or the "outward discharge," we shall consider it first, and simply refer to the well-known "Barker Mill," or the "Whitelaw & Sterret," sometimes called the "Archimedian" wheel, as the first modern type of this style.

In 1827, Mr. Fourneyron applied this principle of the outward discharge from a pipe to a wheel with curved buckets placed outside of the apertures of discharge, so as to receive the water in a direction perpendicular to the first and inner element of the curve, which appears to be practically cycloidal, and which, revolving from the action of the water, finally discharged it at its outer element at the circumference, with its force exhausted—i. e., the best results obtained from this form of turbine were shown by Mr. Francis, in his "Hydraulic Experiments," to be when the circumference of the wheel at the point of discharge had reached the velocity due to the water under the fall, or 62% of the theoretical velocity due the head, from the action of gravity, this being the result of what is known as the "contracted vein." At this velocity of the wheel, the water falls away dead into the pit, to take a new direction due to the fall in the "tail-race."

In the Fourneyron turbine, the tube, or feeder, which supplied the water, was closed at the bottom by a concave cone surrounding the wheel shaft, which passed up through it in a pipe, and was not exposed to the water. This cone was surrounded by a number of guide plates, curved like the buckets, but in the opposite direction, and fastened to the cone; and these delivered the water to the buckets in the proper tangential direction. This first turbine of 1827 was followed by another, in 1834, of 7 or 8 HP., which worked at times under a head of only 9 ins.

Then came several others, under higher heads, of 63, 79, 126, and 144 ft., respectively, giving from 71 to 87% net effect of the power of the water.

In 1837 came the celebrated one of St. Blasien, 20 ins. diameter, weighing 105 lbs., under a head of 72 ft., and this was followed by one of 13 ins. diameter, under a head of 354 ft. The width of this wheel across the buckets was only 0.225 in., and it made 2,200 to 2,300 revolutions per minute. It is said to have driven 8,000 cotton spindles, with the other accessory machinery, which would require from 100 to 120 HP., and to have given from 80 to 85% net effect. The apertures of the buckets were so small, however, that the water was all filtered before entering the feeder, to avoid clogging them.

The success of these wheels led to their introduction to this country by the late Uriah A. Boyden, who placed the first ones in Lowell, in 1844, and these were rapidly followed by others, until their use became almost general in the large manufacturing towns of New England. Those built under Mr. Boyden's instructions gave as high as 80% net effect, and he claimed to have got 88% at the Atlantic Mills, in Lawrence.

Their manufacture was taken up by a number of builders, but they did not all obtain such high results, and, owing to the multitude of buckets, with the small apertures, they were liable to become choked by chips and leaves and other floating obstructions, not to speak of fish; for at Fall River the first turbines are said to have been stopped by eels, on their annual migrations to the sea from Watuppa Lake.

The net effect at partial gate was also very poor, owing to cutting off the water by the sharp edge of a cylinder, as shown by the writer in a paper presented to this Society ("Transactions," Vol. III.).

Attempts have been made to obviate this by introducing diaphragms in the buckets, so that only a part of the bucket is affected by this sharp cut-off, and this is shown in the Swiss turbines, now being introduced at Niagara Falls, but this division only reduces the dimensions of the apertures, and renders them more liable to choke from obstructions. This form of wheel, as built by Mr. Boyden, was also enormously expensive, and they have generally given place, as they wore out, in forty or more years' use, to the "inward and downward flow" turbine, which we shall now proceed to trace. This, as we said in the outset, comes from the old "flutter-wheel" of radial vanes inserted in a central shaft, which supported a grindstone, or "millstone," on top of it, and which is one of the earliest traces of mechanical application of force to be found in history. In 1804, a patent was granted to Benjamin Tyler, of Lebanon, N. H., for "an improvement in water-wheels," in which he claimed "hooping the wheel with iron hoops," and specified the proper angle at which to set the buckets, "made of winding timber."

Similar improvements were early made in the mountainous districts of France, where metal buckets, curved either vertically or horizontally, were bolted to a central shaft, and were known either as "rouets a cuve" or "rouets volants," and in common parlance with us were known as "tub wheels." The water was applied to all these wheels "tangentially," by a trunk or spout which delivered it at the circumference. Next, this trunk was made in the form of an Archimedian scroll, which applied the water equally all around the wheel, the top being closed, and the discharge at the bottom. A wheel of this sort was patented by John Tyler, grandson of Benjamin, above referred to, in 1855. As early as 1843, Elwood Morris, of Philadelphia, experimented with and reported on what is generally known as the "Jonval turbine," in which the radial buckets are curved vertically, and the water directed to them by a set of stationary guides, curved in the opposite direction, and fixed to the interior of the tube or feeder which supplied the water. This form of wheel has also been known as the "Koechlin" and as the "Froment" turbine; the name of "Jonval," I believe, only applies properly to the "draft tube" arrangement, which was patented in this country by Zebulon and Amasa Parker, of Licking, O., in 1840.

These wheels were sometimes, in cases of low heads, set directly in the bottom of the wooden flume or forebay, in other cases supplied by an iron feeder pipe. The Froment turbine, which the writer saw in the London Crystal Palace of 1851, was of the former character, and the gates were a series of "plungers," which fitted down between the guides. J. P. Collins, of Norwich, Conn., has adopted this form of gate; others, as Mr. Geyelin, of Philadelphia, have used what is known as the register gate, a term derived from the common hot-air heating apparatus. Still another form has been a sliding telescopic tube, outside, which throttles the water after leaving the wheel, and seems to the writer objectionable, but has been applied to the turbines at Niagara.

This class of wheels, known as the "downward flow," has proved effective and economical, and they are particularly suited for large and constant powers at low heads, but are deficient at partial gate, if the gate is of the register or telescope pattern. The writer has obtained 84% net effect, with two "Geyelin" turbines, in different localities, when at "full gate."

We must now turn to a different form of wheel, the "inward flow," patented in 1838 by Samuel B. Howd, of Geneva, N. Y. In this the action of the Fourneyron wheel is reversed, and the converging guides, which were straight, were placed outside the wheel, which had curved buckets, revolving inside the guides, and was, in fact, only one form of the old "tub wheel." Mr. Francis has stated (see "Hydraulic Experiments") that a similar wheel was suggested by General Poncelet, in 1826. In the Howd wheel, the regulating gates were placed outside the guides or "chutes." The buckets were cast iron, fastened by bolts to wooden top and base plates, and the discharge was central.

In 1840 Mr. Francis took this matter up, and built, for the Boott Mills, in Lowell, an inward discharge wheel, in which he employed the carefully designed curves of the "Boyden" wheel, and which gave excellent results, nearly equal to those of the outward discharge.

This type of inward discharge gave much greater facilities for operating the gates, and was followed by a number of variations, notably the "American Turbine," of Stout, Mills & Temple, of Dayton, O., in which the form of gate adopted gave much better results than were obtained when partially closed, by the cylinder between the guides and buckets, which Mr. Francis copied from Mr. Boyden. This wheel at the Boott Mills lasted until 1875, when it was replaced by a "Swain wheel." In 1855, A. M. Swain, a mechanic who had been employed at the Lowell machine shop in the construction of the Boyden and Francis wheels, conceived an idea which produced the prototype and exemplar of all the modern American turbines. He combined the inward and downward flow wheels, curving the buckets both laterally and vertically, and discharging the water mainly downward, where a reversed curve in the base on which the wheel rested threw it outward again, so that the path of the water was a semi-circle. He adopted a form of gate which, instead of cutting off the water abruptly, closed the orifice by which it entered the wheel, by lifting the lower side of the tube, so as to contract the passage, which still retained a rounded aperture. The result produced by this was marvellous; instead of 30% effect at part gate, or half water, he got 66%, and 83.4% at full gate, when the wheel was finally perfected in 1875.

The Swain wheel had, however, given an excellent result as far back as 1862, and from that date down to about 1878 the number of turbines was legion, in all sorts of variations of curve of bucket and form of gate, but all containing the same general features of inward and downward discharge. Of these, the Leffel wheel combined both forms of bucket, separated by a diaphragm in the same wheel, and has given excellent effects.

The general result of this change from the Fourneyron type, as first introduced, has been to furnish the public with turbines of equal power, in one-half the space and at one-fifth the cost, being single castings of iron or bronze, instead of built up of many parts. The general line of evolution, beginning with the Swain wheel, has been that of fewer and deeper buckets, with wider openings, to avoid obstruction by floating matter, and in some of the wheels, like the Hercules, the narrow openings of the "chutes" have been retained, preventing such matter from entering the wheel itself.

This latter wheel brings us to the date of 1876, when what is known as the "new departure" wheels were introduced. The first of these was the "Hercules," designed by John B. McCormick, of Brookville, Pa., who brought it to the Holyoke testing flume to be tried, and the results were such that the Holyoke Machine Co. at once entered into its manufacture. The principal feature of this wheel was a much smaller diameter, with longer buckets and deeper openings, for any proposed amount of power.

This wheel was at once followed by the "Victor," made by Stilwell & Bierce, of Dayton, O., on the same general lines, but differing in form of bucket and gate; and many of the older wheels have since changed or improved in the same direction, and the following table will show the difference in quantity of water used and power obtained by a number of wheels of nearly the same diameter, under the same head of 26 ft., beginning with the "Boyden Fourneyron," and ending with the "Victor":

| | Diameter, ins. | Cu. ft. water per sec. | HP. |
|---|---|---|---|
| Boyden Fourneyron | 36 | 22.95 | 55 |
| Risdon | 36 | 35.45 | 89 |
| Risdon "L. C." | 36 | 48.27 | 121 |
| Risdon "D. C." | 36 | 80 | 199 |
| Leffel, Standard | 35 | 40.45 | 96 |
| Leffel, Special | 35 | 60 | 148 |
| Tyler | 36 | 40.7 | 95.8 |
| Swain | 36 | 58.2 | 140 |
| Hunt, "Swain Bucket" | 36 | 48.8 | 121 |
| Hunt, New Style | 36 | 98 | 239.74 |
| Leffel, "Samson" | 35 | 109.1 | 264 |
| "Hercules" | 36 | 107.6 | 253.5 |
| Victor | 35 | 106.8 | 266 |

This enormous difference in productive effect in wheels of the same diameter shows the great economy

of the later type of turbines, particularly as all the wheels above named have a proved efficiency of 80%, and some of them have given more; such as 87% for the Risdon, tested by Mr. Edward Sawyer, of Boston, at Crompton, R. I., and by the writer at the Centennial; 87% for the Hercules, tested by Professor Thurston; 84% for the Collins, by the same authority; 84%, nearly, for the Swain, by Mr. Francis; 84% for the Geyelin and the Hunt, tested by the writer, and 88% for a 15-in. Victor, by the same, but this was so small a wheel that the test cannot be depended on. Later tests of large wheels at the Holyoke flume give over 80%, and to these may be added the "Success" of E. Morgan Smith, York, Pa., and the "Humphrey," Keene, N. H., and the wheel of Gates Curtis, of Ogdensburg, N. Y.; also the "New American," of the Dayton Globe Iron Works, Dayton, O. Here all questions of selections must be governed by other reasons than that of mere efficiency, as all the above seventeen wheels have been proved to give 80% or over net effect. Nearly all these wheels have been adapted to horizontal shafts, for high heads, where the belt pulleys can be kept out of water, and so far as they have been tested show no difference in economy from that given on vertical shafts. A "Hunt" wheel, tested by Mr. Francis in situ, in a mill at Lowell, only varied a fraction of 1% on a horizontal shaft, from the result obtained on a vertical one by Mr. Herschel, at the testing flume in Holyoke.

While the writer has expressed a preference for the "downward flow" wheel when the head was low, and bevel gears necessary, he would prefer the new type of small diameter wheels for horizontal shafts under high heads, as they give a greater initial velocity to the shafting, the friction of bevel gears is avoided, and if set in pairs, to thrust against each other, step friction, which is very destructive in muddy streams, is also done away with.

The first instance in which turbines were placed in pairs in this manner, in the writer's memory, was in 1875, when A. M. Swain installed a pair at Ticonderoga, N. Y., which were very successful. Since then all the prominent wheel builders have adopted it, and it has become very general in all cases where the head was sufficient to keep the pulleys out of water. It also gives the advantage of easy and immediate access to the wheel for examination or repairs, by a manhole in the case, if the head-gates to the feeder are closed. The writer installed a pair of Risdon turbines for the Nashua Manufacturing Co. in this way some time since, and, asking the man who had charge of them, after two years' use, "If anything had been required to be done to them?" he answered, "Nothing but to oil the stuffing-boxes, and open and shut the gates." Like all other water-wheels, the turbine is somewhat slow in answering to regulation under a variable load, as it takes more time to open and close the gates than it does to trip the "cut-off" in a Corliss engine, but both the "Snow" and "Schofield" governors are very effective, and can be recommended.

In the testing of turbines "in situ," a few points need careful attention. The friction pulley should be flanged, to keep the brake in place, and amply strong, and a safe size for it is to allow 1 sq. ft. of surface motion per second for every 3,000 ft.-lbs. per second lifted. This gives a pressure of a little over 20 lbs. per sq. in. The brake should be of timber, fitted to the pulley, one-third the circumference on each edge, leaving two openings of one-sixth circumference for lubrication. The best lubricant is strong, thick soapsuds, about the consistency of molasses, and this should be constantly fed from a can, or cans, in a stream the size of a quill, and may be diluted in use by a jet of cold water from a hose or pipe, played in through the openings, to cool the pulley. The brake lever is most convenient if made the radius of either a 33-ft. or a 66-ft. circle, that is, practically, 5 ft. 3 ins., or 10 ft. 6 ins. long from center of shaft to point of attachment of weight. The whole apparatus should be perfectly balanced at rest before commencing operations.

With a worm shaft and gear, tapped into the wheel shaft, so as to ring a bell every 100 revolutions, the speed is ascertained, and the weight in the scale being known, the horse-power is quickly calculated. Professor Thurston's paper on "Turbine Testing," in Vol. VIII. ("Trans. Am. Soc. M. E."), and Mr. Francis's "Hydraulic Experiments," give data as to the measurement of water, if the net effect of the wheel is also to be arrived at.

When we come to the matter of cost, we find it to vary much in different localities, according to the expense of development. The cost at Lowell, when the first "mill powers" were opened, had been only $40 per HP. for dam, land and canals. This was increased to $50 per HP. by the new canal, which gave more certain head, and enabled the mills to use the surplus water which ran to waste part of the year, and the total cost has probably been $100 per HP., to which another $100 is to be added for the expensive Boyden wheels and massive masonry pits. At Augusta, Ga., the canals, nine miles long, cost the city, which leases the power, $90 per HP. At Columbia, S. C., for five miles of canals the cost to the city has been $72 per HP.

In many cases of smaller enterprises it has been less than $50 per HP., and the total cost, including wheels and pits, less than $100, and we will now give the data of the cost of water-power as developed within recent years at three different points, showing the outlay, and a fair allowance for interest and running expenses.

The first instance is that of the Concord Water Power Co., on the Merrimac River, at Concord, N. H. The power developed is at a minimum 3,300 HP., on an average 5,000 HP. from a fall of 22 ft. The wheels are "Rodney Hunt" turbines, set in pairs on horizontal shafts of 400 HP. The cost has been as follows:

| | |
|---|---|
| 700 acres land, and flowage rights | $20,000 |
| Dam and abutments | 141,015 |
| Canal, 60 ft. wide | 27,363 |
| Head gates | 16,615 |
| Waste Weir | 5,220 |
| Making an investment for water of | $210,273 |

or $63.72 for the minimum amount of power, or $42.05 for the average amount of power. To this is to be added, pits and foundations put in for 2,000 HP., $15,000, or $7.50 per HP. Wheels put in for 1,600 HP., $12,225, or $7.66 per HP., making a total, for the minimum flow of water, of $78.88 per HP., and for the average flow, of $57.75 per HP.

If we base our calculation of cost on the minimum flow, and allow interest, 5%, sinking fund, 2½%, repairs, 1½%, taxes, etc., 1%, we get a total annual cost of 10%, or $7.89 per HP., to which add oil and attendance, 75 cts., making $8.64.

As this power is to be transmitted, in part at least, to Concord by electricity, the cost of such transmission will have to be added to this. If, on the other hand, it is to be partially used near at hand, it is safe to say that the cost of transmission by shafts and belts would not increase it to over $10 per HP.

If we assume the average flow of 5,000 HP., the cost of the power at the wheels would be only $5.72, but we should then require the additional expense of a steam plant, and its operation, to produce the 1,700 HP. deficiency at low water.

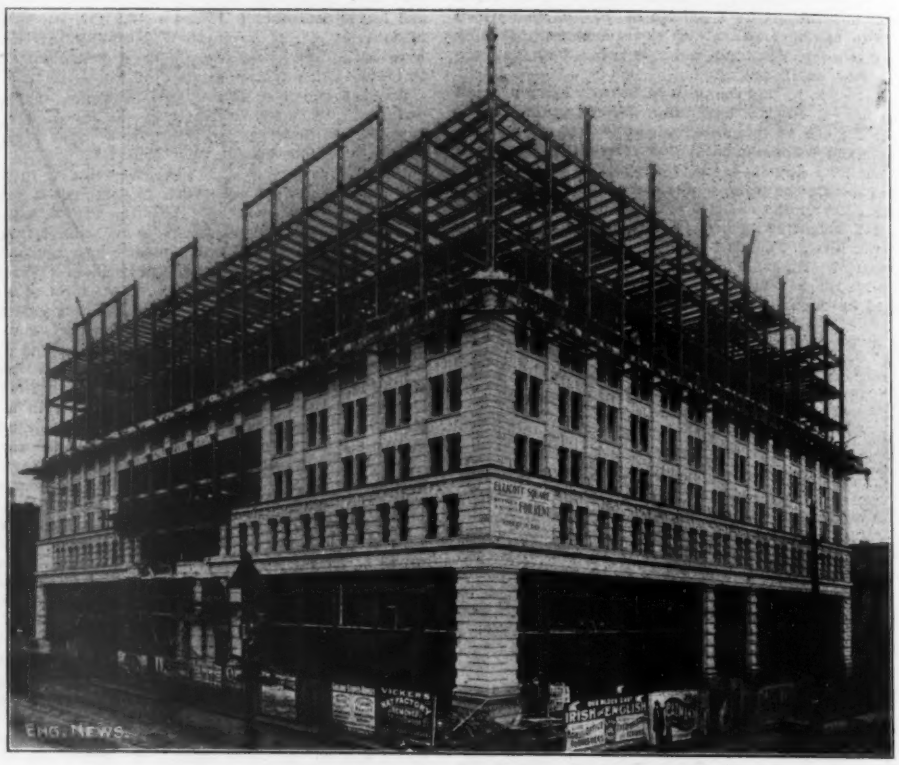
We will now take a large Southern mill, the John P. King, at Augusta, Ga. Here the water is purchased of the city at a rental of $5 per annum per gross HP.

The wheels are three Geyelin turbines, on vertical shafts with bevel gears, estimated at 1,835.5 gross HP. These wheels, by my own test in situ, netted 84%. Calling the average 80%, it gives 1,468 net HP. This cost of plant was for wheel-pits, 42 ft. deep, in rock, head race, 200 by 40, tail race, 800 ft. to river, about $25,000, and the wheels and jack shaft cost the same, or $50,000 in all. This, for 1,468 net HP., is $34.20 per HP., or, at 10%, $3.42; water rent, $5.50 on 1,835.5 gross HP., equal, net, $6.88; attendance and oil, 75 cts., making a total cost of $11.05.

The next case is that of the Columbia Mills, at Columbia, S. C. Here the water is also leased at a rental of $5 per HP. For quantities less than 500 HP. the charge is $7. The fall is 27 ft., and the power is furnished by Victor turbines, on horizontal shafts, and is transmitted by electricity to the mills.

Quicksands made the wheel-pits very expensive, by the quantity of concrete masonry required, so that for all expenses of pits, races, power-house, etc., we have $55,000 for 2,000 HP. The wheels cost $20,000 more, so that we have a total expenditure of $75,000 for 2,000 HP., or $37.50 per HP. This, at 10%, as before, gives $3.75 per HP.; water rent, $5 per HP., attendance and oil, 75 cts., making a cost at wheels of $9.50 per HP.

As the water rent paid in the last two cases covers interest and depreciation, while the cities which furnish the water also obtain their own supply for other purposes, it will be seen that it covers the cost, and that the estimate of Mr. Samuel Batchelder, fifty years ago, that the cost of water-power in Lowell, including land, was under $15 per annum per HP., was substantially correct, and will cover the cost of water-power with modern turbines, under fair circumstances, to-day, with plenty of room to spare for heating.




THE ELLICOTT-SQUARE OFFICE BUILDING, BUFFALO, N. Y.
D. H. Burnham & Co., Chicago, Ill., Architects. Jonathan Clark & Sons, Chicago, Ill., Contractors.

## THE ELLICOTT-SQUARE BUILDING, BUFFALO, N. Y.

We present herewith a view of the partially completed Ellicott-Square office building, which is now being erected at Buffalo, N. Y. The illustration gives a good idea of both the ironwork and the exterior finish of the building, and also indicates clearly its great lateral dimensions as compared with its height of 10 stories, the building in this respect showing a very refreshing contrast to the usual chimneylike appearance of the modern "skyscraper."

The Ellicott-Square Building occupies a ground area of 240 × 200 ft., with an open court 70 × 110 ft. in the center, and will be 10 stories high at present, although the foundations and ironwork are designed for 20 stories, should more space ever be demanded. Isolated column foundations of steel beams and concrete are used, and the columns are of the Gray type (Eng. News, June 7, 1894), with the outside columns tied together at the floor lines with deep plate girders to provide lateral stiffness. The live load provided for is 100 lbs. per sq. ft.

The exterior finish will be granite and terra cotta to the top of the second story, and terra cotta and brick veneer above. The interior finish will be mosaic and marble in the corridors, and red oak and maple in the offices. To provide communication between the different floors there will

be 16 elevators and the usual stairways. There will be electric light, steam heat and toilet stands in each office, and many of them will also have telephone connections, safety vaults, etc., while in the building there will be the usual messenger service, postal service, etc. This building has been claimed to be the largest office building in America.

The building is being erected for the Ellicott Square Co., of Buffalo, N. Y., by Jonathan Clark & Sons, of Chicago, Ill. The architects are D. H. Burnham & Co., of Chicago, Ill., and Mr. E. C. Shankland, M. Am. Soc. C. E., of that firm, was the designer of the ironwork.

## SUBMERGED CAST IRON PIPE INTAKE FOR THE WATER-WORKS OF ERIE, PA.

By Walter C. Brough, Designing and Constructing Engineer.

The necessity for a purer and more abundant supply of water had been agitating the minds of the commissioners of water-works of the city of Erie, Pa., for a number of years back, but for lack of means at their disposal they were unable to take any decided action to obtain such a supply until the summer of 1892. During that year several surveys and analyses of water were made to ascertain the most advantageous source from which to procure the desired supply, with the result that a point 3,500 ft. out in Lake Erie north of the peninsula (Presque Isle) was decided upon.

The grounds for this decision were that the only abundant supply of pure water could be obtained from the lake, and from this point with the least expense. The direction chosen was the most advantageous, as it necessitated the least amount of excavation to give pipe the desired depth and grade, should it be used, and afforded a route equally good in case of tunneling. It was also the most suitably situated, considering the currents and depth of the lake.

The means by which this point of intake should be reached, either by tunneling or by pipes, was duly considered, and was decided in favor of the latter, which raised the question of whether riveted steel or cast iron pipe should have the preference.

The decision was in favor of the latter for the following reasons: (1) Although steel pipes have been used with apparent success in numerous instances, their lasting quality has not been sufficiently verified, whereas that of cast iron has; (2) cast iron is heavier per foot, and therefore not so liable to rise to the surface of water in case of being pumped out (as has been known to occur) if only covered or weighted down to the same extent as steel; (3) the approved process of coating steel pipe, taking into consideration the cost of the necessary plant for doing so, is far more costly than that for cast iron; (4) less depth of trench is required for cast iron than for steel, because less covering is necessary for weight; (5) considering the prices for cast iron pipe in the spring of 1895, the difference in cost of coating, the depth of trench and covering and the mode of making joints under water, without flexible joints, cast iron was preferable to steel.

The size of the pipe to be laid was governed by the amount of water to be delivered, the distance of the intake from the pump-house and the obtainable head, which are respectively 30,000,000 gallons per 24 hours, a distance of 16,000 ft., and an obtainable head of 6 ft. over the top of the pipe below zero-level of Lake Erie. The head was limited by the depth of existing suctions of pumps and location of buildings. The suction of the pumps is 24 ft. when the well where the intake discharges is lowered halfway down the mouth of the pipe.

In order to obtain the foregoing requirements with security, it was decided to lay a 5-ft. pipe from the pump-house to the south shore of the peninsula, and from this latter point a 5½-ft. pipe across the peninsula and out into the lake 3,500 ft., terminating in a submerged wooden crib furnished with oak gratings, as shown in the map, Fig. 1. It is also proposed to construct a settling basin on the peninsula to be used when the lake becomes rough.

During the year 1895 the intention is to lay the first 8,200 ft. only, and place a temporary submerged crib over and protecting an upright T-branch at its outer extremity. When the pipe line is extended this inlet will be capped.

The accompanying map, Fig. 1, and profile, Fig. 2, show the location and grades of this portion of the undertaking. The general depth of the pipe below the bottom of the bay is 3 ft., necessitating the excavation of a trench varying in depth from 8 to 10 ft. The major portion of the first 3,000 ft. is in rock, shaly at the surface near the shore end, but becoming much harder towards its outer extremity, where strata are met with varying from 24 to 30 ins. thick. The remainder of the trench for this season's work is in a blue quicksand mud, while the balance of the excavation for future operations will be in sharp sand, except when passing through the peninsula, where a boggy marsh is encountered.

The pipe is supplied by the Addyston Pipe & Steel Co., of Cincinnati, O., and is in lengths 12 ft. 5 ins. over all, 5 ft. interior diameter, and has a shell 1 5-16 ins. thick. It is of the ordinary bell and spigot pattern, the bell being 5 ins. deep. It is coated by immersion in Dr. R. A. Smith's patent coating, and when completed each length weighs 10,300 lbs., with a variable allowance of 3%. Each pipe is tested to a water pressure of 200 lbs. per sq. in., and while under this pressure is thoroughly hammered. The castings delivered have been smooth, clean and regular in form.

Every sixth pipe has the spigot end turned off to a taper of ⅛ in., 5 ins. in length. Six pipes form what is called "a section." These are joined together on skids on shore in a perfectly level and straight line, and are yarned, run with lead and calked in the usual manner.

One of the pipes with the turned taper spigot constitutes the first length of each section; the pipe at the other end of the section has a bell in which a molding of lead is run conforming exactly to the turned taper spigot of the succeeding section. Two bands of iron, with two lugs each, are placed round the sections, as shown in Fig. 3, one on the hind end of the second pipe and another behind the bell of the last pipe of the last section laid; through the lugs of these bands iron rods, 14 ft. long by 1¼ ins. in diameter, with threaded ends for nuts, are slipped, and by them the spigot of the succeeding section is drawn home and secured into the bell of the previously-laid section, forming a joint very similar to that known as the turned and bored joint.

This special mode of connection under water has been patented by the designers, Messrs. Thacher & Breymann, of Toledo, O., who have the contract for laying the intake. Their plant for this contract is complete and unique, they being at all times prepared for the various emergencies which invariably turn up from time to time. Besides the powerful dredges, with their accompanying scows and tugs and drill boats, they have centrifugal pumps of various sizes for removing mud or sand from, or leveling the bottom of, the trench; also a jet pump for forcing material underneath the pipe, to give it an even bearing; scows with hoisting engines and derricks for handling pipes, the derricks being furnished with spiral springs to overcome the influence of the rocking of the scow caused by the waves or swell of the lake.

Their apparatus for running the lead joints is simple and good, as it enables a full joint of 160 lbs. to be run at one pouring while the lead is hot. It consists of a wire cable suspended on supports about 10 ft. high, as shown in the view, Fig. 4, drawn from a photograph, and strung above the skids where the pipe sections are made up. It is anchored in the ground a little beyond each end of the section. Near one end of this cable the lead furnace is placed, and from it a smaller pot, capable of holding nearly 600 lbs. of lead, is filled and hauled up to a trolley which runs on the cable to immediately above the joint to be made, and is held there at the desired elevation by a "sure-grip block," when the pot is slightly tipped and the lead poured. A thick rubber band with clamps, known as a pipe jointer, is used for retaining the molten lead in the joint, instead of the usual clay roll.

After the pipe sections are completely made up, their ends are closed by temporary wooden heads. The sections are then gently rolled off the skids on an inclined plane, Fig. 4, into the water, where they are caught on rope lines between two rows of wrought iron casks and by hooks and tackle hanging from raised derricks projecting over the sides of a large scow, as shown by Fig. 5, also drawn from a photograph. The scow, with pipe attached as above described, is towed out to position in line of the trench, where the temporary wooden head on the end of the pipe to be connected is removed and the section allowed to fill with water and sink. This puts the weight of the section on the derricks and casks, but principally on the latter, and therefore the section can be easily shifted in any desired direction by moving the scow or by the winches of the derricks. The scow is shifted by anchors and lines, two of which lead from each side and one from each end.

Each section, composed of six pipes, averages in length 72.8 ft. before joining up, and at each side of the section while being towed out and lowered into the trench there are 12 casks, making 24 in all. The casks are 3½ × 5½ ft., constructed of ⅛-in. wrought iron, having concave ends, and are protected by a jacket of 2 × 4-in. wooden strips, wired together. This protecting jacket is very necessary, as the casks come up with such tremendous force when the ropes under the sections are cut, setting them free, that without such protection they would knock and indent each other, thereby causing leakage and rendering them useless.

The sections weigh approximately 31½ tons, including the 160 lbs. of lead in each joint; but from the buoyancy of the casks the section is easily slightly shifted by the diver, who goes down beneath water to enter the spigot into the bell of the previously-laid section. The diver first removes the temporary wooden head at the outer end of the laid pipe, which has been left on for the purpose of testing the tightness of the pipes laid, and also to exclude mud or other deposit from the pipes. When the spigot of the pipe to be laid is exactly opposite the bell of the laid pipe, it is entered into the same by pulling on the stern anchor of the scow, and is then tightened up and sent home by the assistance of the iron rods and bands described above. After this the casks are cut loose and the section allowed to settle and take a bearing on the bottom of the trench, when the slip joint just made is calked by the diver.

The excavation for the trench has been done by the plant of Messrs. Hingston & Woods, of Buffalo, whose employees on the dredges deserve great credit for the manner in which they adhered to the specified grades in the rock, the pipes laid varying but slightly either way from their designed positions.

As the pipelaying proceeds tests are constantly made to prove the tightness of the work. This is done in the following manner: The temporary head at the outer end of the last section laid still remaining on the pipe, the water in the manhole on the shore end of the intake is pumped down several feet below the surface of the lake; a float with gage attached is placed in the manhole, when observations are taken to ascertain whether the float remains stationary or rises; if the latter, at what rate. The leakage, if any, and the amount can thus easily be detected and the cause of the trouble remedied before the pipe is finally covered by sand or mud.

Plans and sections of the temporary intake crib are shown by Fig. 6.

Work was commenced on May 9, 1895. There are 3,390 ft. of pipe laid (Nov. 20) and about 3,500 ft. of trenching completed. Nearly the whole of the work thus far completed was in rock cutting, varying from 5 to 6 ft. deep, with 3 to 4 ft. of earth over it. The price of the 5-ft. cast iron pipe, f. o. b. cars at Erie, was $18 per ton. The price of laying and joining pipe, setting valve, also constructing and placing temporary intake crib, was let at $6.35 per foot, all complete, calculated on a basis of 8,200 ft., with an allowable variation of not more than 100 ft.

Judging from the efficiency of the plant, the experience and constant personal attention of the

contractors, and from the results of tests already made, I believe the work will be as good as any of its kind yet performed. In conclusion, I think it worthy of mention that the Commissioners, Messrs. Hardwick, Brown and Shacklett, as well as their secretary and treasurer, Mr. Wm. Himrod, have shown great perseverance in having the work carried out which they conceived necessary. Their interest and personal assistance doubtless account to a great extent for the satisfactory character of the work done.

## TESTS OF A 10-HP. DE LAVAL STEAM TURBINE.*

By William F. M. Goss, M. Am. Soc. M. E.**

The De Laval steam turbine experimented upon constitutes a part of the permanent equipment of the engineering laboratory of Purdue University. In this turbine, jets of steam, delivered from suitable nozzles, are made to impinge against the buckets of a light turbine wheel. The steam enters the buckets from one side of the wheel, and, passing through, is discharged or "exhausted" from the opposite side. The motion of the turbine shaft, which, under the action of the jets, is extremely rapid, is communicated by gearing to a heavier and slower-moving driving shaft carrying a flywheel of small diameter; from this wheel the power of the engine is delivered. Regulation of speed is secured by means of a throttling governor, which controls the pressure of the steam admitted to the nozzles.

The turbine wheel is built up of 63 steel segments, each carrying a bucket and a portion of the light outside rim. The segments are held in place by means of suitable collars, which grip them on either side. The wheel is mounted upon a long, slender shaft, having sufficient flexibility to allow the system at speed to revolve about its center of gravity, even though this may not agree with the geometrical axis of the shaft. The gear upon the turbine shaft is of steel, solid with the shaft; that upon the drive shaft has its teeth formed in a bronze ring, which is carried by a solid iron center. The smaller gear has 21 teeth, the larger one 208 teeth.

The nozzles which serve to deliver steam to the wheel are four in number, so fixed as to act upon the wheel at points equally distant from each other. By means of stop-cocks, the engine may be run under the action of two, three, or four nozzles, at the will of the engineer.

The distinguishing feature of the engine, perhaps, is to be found in the form of the nozzles. All are diverging, the throat or smallest diameter being approximately 2 ins. from the discharge end. Three have a diameter in the throat of 0.138 in. and one a diameter of 0.157 in.

It is assumed that the form of the nozzles is such that the pressure of the steam as it passes from the orifice will be that of the surrounding medium; and, since the flow is nearly adiabatic, it is clear that if this condition is realized, all the energy of pressure is transformed into energy of motion before the steam is allowed to impinge upon the buckets of the turbine wheel. The medium surrounding the nozzles in the machine is practically that of the exhaust, so that the expansion from the pressure of the boiler to that of the exhaust is complete before the steam has contact with any moving part of the machine.

In the tests the power of the engine was absorbed by a Prony brake, cooled by constant streams of water. The exhaust steam was piped to a Wheeler condenser, open to the atmosphere. The water resulting from condensation was drained into tin buckets, which were changed and weighed at regular intervals.

The boiler pressure for all efficiency tests was 130 lbs. by gage, for which pressure the particular nozzles used were designed. The rated speed of the flywheel is 2,400 revolutions per minute (23,771 for turbine wheel), but this standard was not maintained for all the tests. The governor was adjusted several times as the work progressed, and it was not until several tests had been run that the proper speed was secured.

The tests are grouped into three series, the first including those for which all four nozzles were in action, the second those with three, and the third with two. The several tests in each series were intended to vary from each other only in amount of power delivered from the wheel. All tests were of 30 minutes' duration, and all observations were taken at five-minute intervals. The conditions of each test were maintained with such uniformity that the observations of any five-minute interval were very nearly identical with the average of all observations taken for the test.

The observed and calculated results appear in tabulated form below (Table I.):

TABLE I.—Summary of Results of Tests of De Laval Steam Turbines.

| No. of test. | Revs. per min. of belt wheel. | Brake HP. | Steam pressures by gage.—In boiler. | Steam pressures by gage.—In engine below gov. valve. | Lbs. steam per hour. | Lbs. steam per brake-HP. per hour. |
|---|---|---|---|---|---|---|
| All four nozzles in action, three having a diam. in throat of 0.138 in. and one a diam. in throat of 0.157 in.: | | | | | | |
| 1 | 2,138 | 0.00 | 130 | 17.1 | 120.8 | .... |
| 2 | 2,545 | 1.63 | 130 | 42.2 | 210.3 | 128.6 |
| 3 | 2,038 | 2.36 | 130 | 48.5 | 230.8 | 99.8 |
| 4 | 2,118 | 2.97 | 130 | 55.6 | 254.6 | 85.7 |
| 5 | 1,917 | 3.46 | 130 | 61.9 | 275.5 | 79.6 |
| 6 | 2,072 | 4.38 | 130 | 70.8 | 313.0 | 71.5 |
| 7 | 2,128 | 5.10 | 130 | 76.9 | 328.5 | 64.4 |
| 8 | 2,576 | 7.52 | 130 | 99.6 | 403.0 | 53.6 |
| 9 | 2,453 | 8.24 | 130 | 104.4 | 422.8 | 51.3 |
| 10 | 2,411 | 10.33 | 130 | 126.3 | 491.8 | 47.8 |
| Three nozzles in action, two having a diam. in throat of 0.138 in., and one a diam. in throat of 0.157 in.: | | | | | | |
| 11 | 2,584 | 0.00 | 130 | 31.3 | 121.4 | .... |
| 12 | 2,112 | 3.95 | 130 | 83.6 | 267.8 | 67.8 |
| 13 | 2,125 | 4.77 | 130 | 93.4 | 286.0 | 60.0 |
| 14 | 2,490 | 6.50 | 130 | 111.7 | 346.3 | 53.3 |
| Two nozzles in action, each having a diameter in throat of 0.138 in.: | | | | | | |
| 15 | 2,546 | 0.00 | 130 | 42.2 | 99.3 | .... |
| 16 | 2,049 | 1.95 | 130 | 83.5 | 162.6 | 83.4 |
| 17 | 1,909 | 3.43 | 130 | 121.1 | 222.9 | 65.0 |
| 18 | 2,412 | 3.87 | 130 | 127.0 | 229.6 | 59.3 |

It will be seen that, with all four nozzles in action, and with the engine developing a little more than its rated power, the steam consumption per horsepower per hour is as low as 47.8 lbs. In comparing this result with results obtained from other engines, the small size of the engine tested (10 HP.) should be kept in mind, and also the fact that the rate of consumption stated is based upon brake power. The efficiency of the engine falls off rapidly as the load is decreased, and, as would be expected, the effect is most marked when all the nozzles are in action.

The engine requires very little attention, and is almost noiseless in action. The governor is quick to act, and its speed regulation appears to be fair, except when changes of load are large and suddenly made. After such a change, the engine requires a little time before settling down to steady running under the new conditions.

Starting Power.—As the speed of the De Laval engine is high, it is evident that the force in action must be comparatively low. To determine the maximum resistance under which the engine might be expected to start, the brake was clamped upon the flywheel so that the latter could not turn within it. Steam was then admitted to the engine, and readings were taken from the scale under the brake-arm. The result of this process, of course, depends upon the steam pressure and the number of nozzles in action. With all nozzles, and with a steam pressure of about 125 lbs. by gage, the maximum starting power is equal to a force of 30 lbs., acting at a radius of 1 ft. Table II. gives the starting power for different pressures, and when two, three, or four nozzles are in action.

TABLE II.—Starting Power of Engine.

| | 4 nozzles in action. | | 3 nozzles in action. | | 2 nozzles in action. | |
|---|---|---|---|---|---|---|
| Steam press. by gage.. | 125.2 | 71.1 | 125.2 | 71.1 | 125.2 | 71.1 |
| Effective radius of brake-arm, ft. ..... | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 |
| Reading of scale under brake-arm, lbs... | 20.0 | 12.1 | 14.1 | 9.0 | 9.5 | 6.0 |
| Equiv. force in lbs., acting at a radius 1 ft.. | 30.0 | 18.2 | 21.2 | 13.5 | 14.3 | 9.0 |

## THE RELIABILITY OF "THROTTLING CALORIMETERS."*

By Jas. E. Denton, M. Am. Soc. M. E.**

The object of this paper is to present the complete results of an investigation of this subject, undertaken at the request of a leading firm of builders of boilers, to determine: (1) Whether it is, or is not, a fact that the proportion of moisture in steam as determined by the accepted methods of using a "throttling calorimeter" may be considerably in excess of the true proportion of such moisture; (2) The conditions under which "throttling calorimeters" should be used, or the precautions necessary in using them, in order to insure practically accurate conclusions regarding the proportion of moisture in the steam under examination.

The investigation has divided itself into the following parts:

I. The entire output of steam from a 75-HP. boiler was made to contain known amounts of moisture while flowing through a 3-in. pipe, the determination of the true percentage of moisture being made to depend entirely on actual weighings of the steam and water involved.

The outlet from the 3-in. pipe was connected with a 75-HP. separator, and with a large throttling chamber, so that the principle of the small "throttling calorimeters with separator attached" could be applied to the entire amount of steam mixture flowing through the pipe. Thereby it was determined that the principle of the "throttling calorimeter" was entirely reliable as a means of determining the percentage of moisture of any mixture which passed through it.

II. Small "throttling calorimeters" were applied to the 3-in. pipe, with the ordinary arrangement of perforated nipple, and it was found that the percentage of moisture shown by them varied considerably from the true percentage, when the conditions were such as to make it probable that the moisture was separated from the steam, or was not distributed throughout the latter when it collided with the nipple of the calorimeter. For instance, when the true moisture was 21% and 17.6%, respectively, the small calorimeter showed 54.8% and 50.8%.

III. Small calorimeters were applied to the 3-in. pipe at the exit from the 75-HP. separator, with the dip pipe to the separator closed, under conditions which fairly insured the thorough distribution of the moisture throughout the current of steam when the latter collided with the calorimeter nipple, and it was found that, while the percentage of moisture shown by them was still liable to exceed the true percentage, the discrepancy was much less than when the conditions were such as to favor the accumulation of the moisture at some part of the surface of the pipe. For instance, when the true moisture was 0.5%, 0.8%, 1%, 1.6%, 2.5%, and 19.1%, respectively, the calorimeter showed 1%, 1.5%, 2.2%, 3.6%, 5.5%, and 31.8%.

The results of I., II. and III. made it evident that, while the small "throttling calorimeter" might be relied upon to determine correctly the amount of moisture in the sample of steam and water which is drawn into the instrument from the larger volume of mixture in a steam main, the percentage of moisture in such a sample may largely exceed the percentage in the steam main, if the moisture in the latter separates itself from the steam so as to accumulate at the point of connection of the calorimeter. It became necessary, therefore, to determine whether, under the usual conditions of good boiler practice—that is, for conditions where the moisture does not exceed 1½%—there can be such a separation of the moisture from the steam so as to cause the erratic indication of the calorimeter.

To investigate this question, two sets of experiments were made, the results of which showed that with steam containing less than ½% moisture, flowing in a steam main, the moisture might separate itself from the steam, and accumulate in the bottom of the pipe in a stream which would impinge against a calorimeter nipple in its path, so as to flow up the side and into the orifice of the latter, thereby causing the indications of the instrument to greatly exaggerate the true percentage of moisture in the main.

The results also clearly indicate that, in traveling a little more than twice the distance in the 3-in. main—which would be necessary in order for a body to fall by gravity through the diameter of the pipe—practically all of the moisture in the steam main would escape through the calorimeter.

These results afford, I think, a key for the explanation of the erratic indications of "throttling calorimeters" in practice, which all extensive users of them have met to a greater or less extent. Variations in the proportions and arrangement of nipples, in the rate of evaporation, relative location of calorimeter, and position of steam mains leading to the point of attachment of the latter, will give rise to an infinite variety of results in the degree of the error which may be involved in the use of the instrument.

All parts of the surface of any form of nozzle inserted in the steam main will act as a collector for moisture, which will adhere to the metal so as to resist being detached by the comparatively swift main current of steam, but which will allow itself to be gradually drawn into the nozzle by the gentler current of steam which flows into the calorimeter, because the latter has only to overcome the resistance to sliding of the water along the metal.

Under this view there seems to be no possible method of depending solely upon small "throttling calorimeters" to determine with certainty the percentage of moisture in a steam main. By using several instruments simultaneously, with the orifices of the nipples located at different parts of the cross-section of the main, or by making the nipple of a single instrument movable so as to explore the interior of the pipe—an approximately correct judgment may be made regarding the average moisture, which will be sufficiently complete for commercial purposes.

By combining a single calorimeter with a separator acting on the whole current in the steam main, however, the source of error in the calorimeter may be so far eliminated as to make its indications reliable. This method is based upon the fact that, by using a separator of sufficiently large proportions to confine the velocity of flow within certain limits, the moisture in the steam

* Abstract of a paper presented at the New York meeting of the American Society of Mechanical Engineers.

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leaving the separator can be reduced from any probable amount to a small fraction of 1%. For example, in the case of the 3-in. Stratton separator, if the velocity of flow is not more than 1,000 ft. per minute, with 27% of moisture in the steam entering the separator, there is practically no moisture in the steam which leaves it. If, therefore, a small "throttling calorimeter" be applied to the steam main at the exit from such a separator, the small amount of moisture there, and the fact that it will be thoroughly intermingled with the steam, make it reasonably certain that its indications will be correct for any arrangement of nipple, and, by combining these with the determinations of drip from the separator, the moisture in the steam generated by the boiler may be completely and reliably determined.

## FUEL SAVING IN A LARGE OIL REFINERY.*

By Charles E. Emery, M. Am. Soc. M. E.

One of the most interesting professional engagements of the writer during the past year has been the study of conditions obtaining in the large oil refinery of the Tidewater Oil Co., at Bayonne, N. J., with a view of recommending means to obtain a saving of fuel. An incredibly large amount of steam is required in such a place. It is used for power to operate the engines for the various manufacturing establishments, such as barrel, can, and box factories; to operate steam pumps to transfer the oil and finished products to different parts of the yards; to press out the paraffine or wax from the heavier oils; to operate hydraulic presses for higher pressures; to pump water in large quantities for cooling purposes, ammonia for refrigeration, etc. Some steam power is also required for electric lighting. A very large part of the steam supply is, however, required for various heating operations connected with refining. In the refinery referred to there were 5,500 HP. of boilers installed in four boiler houses in different parts of the grounds, which boilers were originally forced much beyond their capacity a great deal of the time. The coal consumption for steam purposes amounted to about 64,000 tons per year, independent of which a very large quantity was consumed directly under oil stills. It was found that many of the steam pumps were using as high as 240 lbs. of water per net HP. per hour, and only in exceptional cases could one be found which could deliver a horsepower as low as 80 lbs. of feed-water.

In the preliminary report of the writer, a small electric transmission was recommended to reach various outlying points where steam had to be transmitted a long distance at very great expense in condensation independent of the power developed, since it was necessary in winter and desirable in summer to keep the pipes warm all the time, although the power was at many of the points only used occasionally. An extension of the exhaust system was recommended, even if it became necessary to increase the back pressure, and it was recommended that a number of power stations be established, in which would be erected good high-pressure, non-condensing engines, operating power pumps, to take the place of the numerous steam pumps in different parts of the works, the exhaust from such engines to enter the exhaust mains and to be used for heating purposes. It was pointed out as desirable that the changes be made somewhat slowly, so that experience gained at one plant could be applied at another, and so that the class of engine best adapted for the purpose could be determined. Evidently, if all the exhaust steam would eventually be required for heating, a cheap form of engine could be used; and if the contrary was the case, good compound, condensing engines could be used at some of the locations.

The suggestions were adopted, and considerable work has been done under the immediate direction of the executive officers in consultation with the writer. At the present time the system of local plants operated by high-pressure steam engines and power pumps has been applied at two points in neighborhoods where the least exhaust steam is required, and the exhaust steam from nearly all the engines and the large number if wasteful pumps has been collected and used at a pressure of about 10 lbs. in the steam stills, the results showing that nearly all of it could be utilized. The result of the work thus far accomplished has been to reduce the coal consumption for steam purposes fully one-half, or about 32,000 tons per year. The saving has gradually increased from the time the work was commenced, and has been 54%, compared with the previous year, for the last three months, though the entire work laid out is not yet complete. One of the four boiler houses has been closed, and experiments are in progress to ascertain how many more boilers can be shut down without forcing the remainder above the economical limit. The principal part of the saving has been due to the use of exhaust steam. Its application in steam stills required experiment, so the results could not have been accomplished without the hearty co-operation of the executive officers of the establishment. Before the changes, the yards were overhung by clouds of escaping steam; now hardly any is visible. The fact that so much exhaust steam could be utilized has somewhat modified the original plans of dispensing with all the steam pumps. At points where there is little condensation due to exposure, evidently the lack of efficiency is of minor importance, as the heat passes on and is utilized for heating purposes. In outlying districts, however, there was a large amount of condensation in pipes and pumps necessarily located out in the air in many cases, to avoid danger from fire. A number of these pumps have been housed, so as to save loss by condensation, and power pumps will be substituted for others in another sub-station, thus reducing the surplus of exhaust steam, when improvements will be stopped for a time, until experience indicates the desirability of further change.

The small electric transmission plant previously referred to is now in operation. It is a three-phase alternating system, put in by the General Electric Co. A 75-K-W., 550-volt generator is provided, it having been decided on consultation to make it large enough to furnish all the incandescent lights then supplied from three small plants in different parts of the yard. There are about 60 HP. of motors distributed at outlying points, the units varying from 5 to 30 HP. The electric conductors displace about 2,000 ft. of steam pipe of various sizes, which it was necessary to keep hot winter and summer. In locations where gases exist that a spark would light, the variable starting resistance has been omitted from the motors, and the switch-blades are immersed in oil, so that the electric apparatus is absolutely sparkless. The change has improved the electric lighting, and the motors are also operating quite satisfactorily.

* Abstract of a paper presented at the New York meeting of the American Society of Mechanical Engineers.

## LONGITUDINAL ANGLE STIFFENERS FOR CHORDS OF PLATE GIRDERS.

In connection with the discussion on the use of angle stiffeners for the chords of plate girders in our issues of Nov. 21 and 28, we show herewith, in Fig. 1, two double-track, plate-girder through bridges at the Hartford, Conn., station of the New York, New Haven & Hartford R. R., the top chords of which have two angle irons 1 × 4 × 6 ins. on the outer edges placed so as to form two inverted channels, as shown in Fig. 2. The bridges have a span of 77 ft. 6 ins., and the girders are 7 ft. deep. They were built in 1888 by the Berlin Iron Bridge Co., of East Berlin, Conn., as stated in two letters published in our correspondence column last week. We are indebted to Mr. Wm. G. Miller, of that company, for the photograph from which Fig. 1 has been prepared.

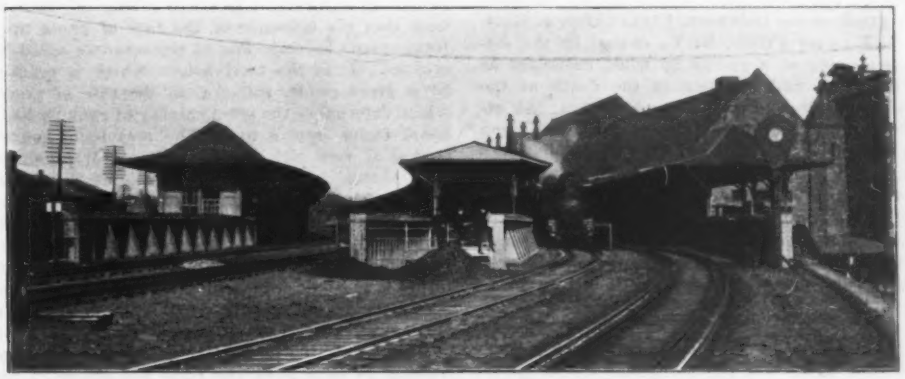

FIG. 1. PLATE GIRDER BRIDGES WITH ANGLE IRON STIFFENERS ON THE TOP CHORDS, HARTFORD, CONN.; N. Y., N. H. & H. R. R.

## COMPARISON OF FORCED AND INDUCED DRAFT FOR STEAM BOILERS.

The relative merits of chimney draft, forced draft and induced draft have frequently given rise to controversy. In recent years induced draft has been much discussed, and it has sometimes been claimed for it that it gives economical results that are superior to those obtained by forced draft. The results of experiments made by the British Admiralty in 1889 at the Portsmouth Navy Yard seemed to favor this claim, but more recent trials on H. M. S. "Gossamer," mentioned in the presidential address of Mr. Albert Durston, Engineer-in-Chief of the Royal Navy, delivered before the Institute of Marine Engineers, showed that there was no marked advantage in favor of induced draft on the score of economy, although the great convenience and comfort due to the conditions involved in working in an open stokehold were very valuable. There should be no essential or necessary difference in the economy of a steam boiler

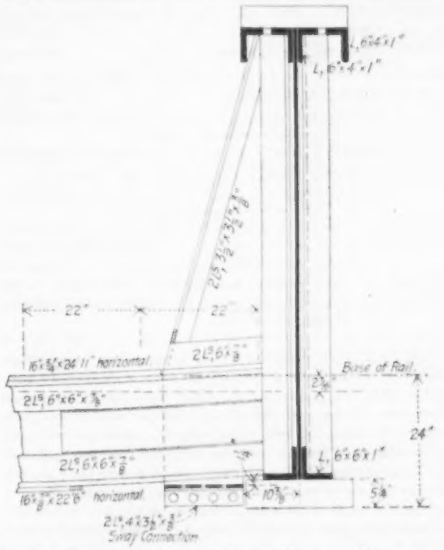


Fig. 2. Cross Section of Plate Girder with Longitudinal Angle Stiffeners on the Chords

whether driven by natural, by forced or by induced draft, provided the same intensity and uniformity of draft is maintained in each case. A chimney 150 ft. high, with a temperature of gases of about 550°, will produce a draft equal to the pressure of 1 in. of water column, or .036 lb. per sq. in. If the pressure of the atmosphere in the external air is 14.7 lbs. per sq. in., the pressure in the chimney is .036 lb. less than this. It would seem to be a matter of indifference, so far as the rate of combustion is concerned, whether the draft of 0.36 lb. per sq. in., which is less than 1-400th part of the total atmospheric pressure, be produced by increasing the pressure under the grate bars that amount, as by a fan or blower, or by reducing the pressure in the flue, either by a tall chimney or by an exhaust fan. All three systems—the chimney, the forced draft and the induced draft—may be considered equal as regards economy whenever they produce equal intensity of draft. There are, however, difficulties with all systems. The chimney has no reserve of power by which the draft may be increased when occasion requires, and the draft is influenced by the weather, besides on steam vessels it is not convenient to build chimneys high enough to give a strong draft. Forced draft and induced draft involve the use and keeping in order of expensive machinery; the former is sometimes objectionable by reason of its forcing gas into the boiler room, or inconvenient to the workmen when the closed stokehold system is used; and the latter requires a larger fan than the former, so that the adoption of either system involves a choice of evils.

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Our remarks last week on the subject of train-wrecking and the need of more stringent laws to punish it, have new force lent them by the fatal train wreck on the Delaware, Lackawanna & Western R. R., near Preble, N. Y., caused by the malicious opening of a switch by some miscreant as yet unknown, and resulting in the death of the engineer and fireman of the wrecked train. An attempt at train wrecking is also reported this week on a branch of the Atlantic City R. R., but was fortunately frustrated. The need of better laws for the punishment of train-wrecking is being actively discussed in the newspapers, and it is to be hoped that advantage may be taken of the popular interest at this time to secure the speedy presentation and passage of such laws by the legislatures which have already assembled in many states.

From one point of view, it seems a hopeless task to attempt to thwart the malignant ingenuity of train-wreckers by the adoption of safety devices of any form; but actually the results of the use or non-use of safety appliances are especially evident in these recent fatal wrecks. In the Rome accident, as we pointed out last week, steam heat and Pintsch gas probably saved the entire train from burning up, as the postal cars were badly shattered. In the Preble accident, all the cars save the one at the rear, which remained on the track, were destroyed by fire, which, according to the press reports, was started by the oil lamps. An argument for those who favor a track circuit for all block signal work is furnished by the fact that a track circuit would have probably given warning of the malicious injury done to the track in both the above accidents in time to have stopped the trains.

Our valued contemporary, the New York "Sun," prints the following editorial comment upon what we understand to be a trade-school rather than one of "technology or civil engineering":

> A new school of technology or civil engineering is to be established at Hartford, as a department of Trinity College. It is a capital idea. Most encouraging to young men were the accounts which we printed last month of the business success of the graduates of the various schools of civil engineering in the United Staes. It is a profession which is not overcrowded, and in which there is a steady demand for trained men, who seem to have better prospects in life than most other men.

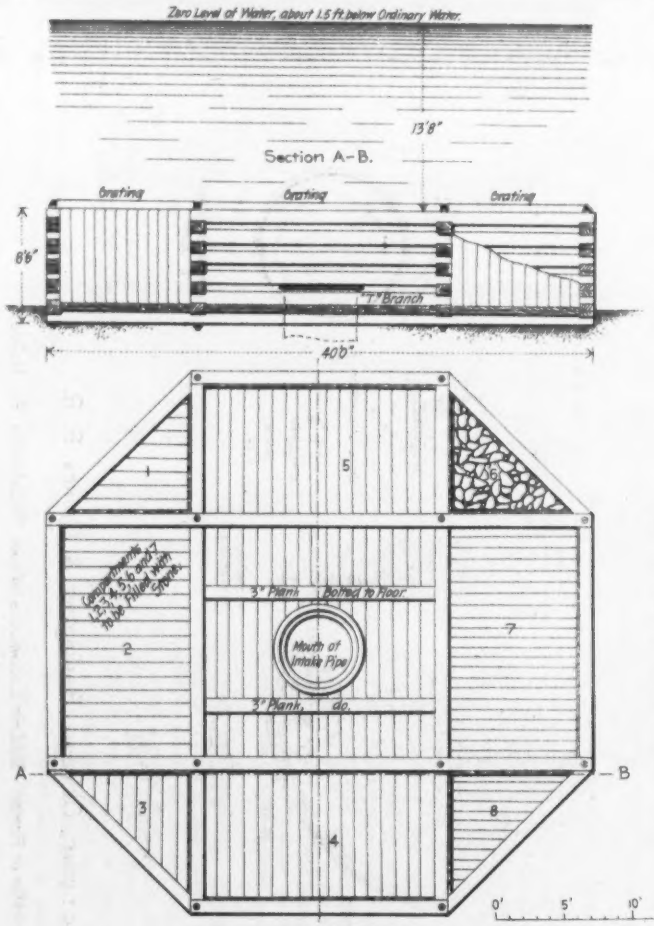
In this statement of the bright future before young engineers in this country and in the declaration that the profession of civil engineering is not overcrowded, the "Sun" is unfortunately very far from the truth, and betrays its deficient knowledge of the situation. We wish in this case that all that our contemporary says were "so," but the reverse is unfortunately the case, and statements like these, if left unchallenged, tend to further crowd a profession, which at this time especially is sadly in want of something to do. The "Sun" apparently is ignorant of the fact that Cornell and the Massachusetts Institute of Technology and Renssalaer and Stevens, to which it lately referred in connection with the excellent record of their graduates, are only a few out of more than a hundred engineering schools in the United States. The general evidence is that the supply of engineering schools is now considerably in excess of the demand. Engineering is a most honorable and useful profession, and one which more than any other fits its members for positions requiring executive ability; and in that way it does hold out some bright rewards to the successful. But such success means natural ability, hard work and favorable opportunities, and young civil engineers do not "have better prospects in life than most other men," simply because of the fact that they are engineers.

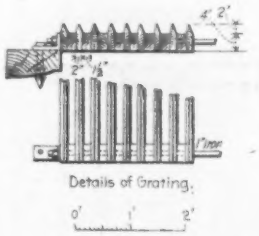
In an interesting paper read Nov. 23 before the Indianapolis Engineering Club, Prof. W. F. M. Goss, M. Am. Soc. M. E., discussed the limitations of speed of railway trains, and outlined what conditions would have to be met in order to run trains at schedule speeds very much higher than those which obtain at present. Among these conditions he stated, if the abstract of the paper sent us is correct, that grades should be light, and recommended a grade of 10 ft. per mile as the maximum for an 80-mile an hour schedule. We presume in the full text of the paper the conditions governing the effect of grades on high speed were more fully stated; at any rate, it is worth calling attention to here that the influence of the rate of grade upon train speeds becomes less as the schedule speed increases. It is the total height which is reached by a given grade, rather than the rate of grade, which determines the practicability of running high-speed trains over a line. The reason, of course, is that at very high speeds the energy represented by a change in the rate of speed is of very great amount, and a train floats over a summit with scarcely a noticeable falling off in the rate of speed. For example, a train running at a speed of 80 miles an hour has a stored energy sufficient to lift it through a vertical height of 227 ft. Suppose when running at such a speed it strikes a ½ per cent. grade two miles long, or a total ascent of 52.8 ft. If the locomotive exerts just the same traction as on a level, the train will arrive at the top of the grade with a stored energy remaining of 227 ft. — 53 ft. = 174 ft., which corresponds to a speed of 70 miles per hour. Hence its average speed upon the grade will be a mean between its speed at the bottom and at the top, or 75 miles per hour. If, now, an equal down grade follows, the locomotive will be able to restore the speed to 80 miles per hour, still working at the same rates as on a level. The train will then have run four miles at an average speed of 75 miles per hour. It will be noticed that if the same conditions are assumed, save that the gradient on both sides of the hill is twice as steep, the actual falling off in speed will be no greater and the delay due to the hill will be only half as great, since only two miles will be run at 75 miles per hour, instead of four miles. As a practical matter, of course, the locomotive is worked harder on the up grade, if possible, which makes the lighter grade preferable.

It should be plain from this discussion that an undulating grade, with elevations or depressions of not more than 50 to 60 ft., above the general elevation, or even more, is no serious obstacle to the running of trains at very high speeds, provided, of course, that no stops in the vicinity of grades are necessary. The higher the speed which is attempted, the less important do these minor undulations become. On the other hand, a long grade, even if it be a very easy one, is a serious obstacle to high speeds, because at such speeds the locomotive always is forced nearly to its maximum power, and has very little reserve to draw upon to offset the increased train resistance which the grade causes.

The late suicide of City Engineer Eaton, of Somerville, Mass., seems to have been the direct result of petty and false charges made against his integrity by parties seeking his office for another man. The charges started with a discharged subordinate, and were nursed and brought forward by interested parties. Unfortunately Mr. Eaton was an exceedingly sensitive and retiring man, and was, in addition, much overworked in his official capacity. Under the strain brought upon him during the investigation he gave way, and in a fit of temporary insanity took his life. Had he been a man of different temperament, he would probably have fought his enemies, exposed their real animus, and gone serenely on his way; but the incident is another illustration of the trials to which city engineers are subjected and the extent to which political and selfish interests in their aldermanic masters may be carried.

The experience in Somerville is also evidence that for the successful conduct of his office the city engineer needs something besides a technical fitness for his professional duties. Technically fitted he must be, but he should also understand men and the world, and have the fighting instinct well developed, so that he may be able to effectively defend his personal reputation and the public interests over which he is placed in charge. By this it is not meant that he should be contentious, but he must have sufficient forcefulness to convince the average alderman of the benefits to be derived from certain work and the public necessity for such work, and to combat the narrow views too often taken by his masters from ignorance of controlling conditions. In other cases he must resist pressure springing from less honest motives; and, in fact, the city engineer should not only be an able engineer of experience, but also a shrew, forcible business man, honest and conscientious himself, and capable of compelling the general conduct of all that pertains to his office on like principles and against ignorant objection. Under the usual conditions of appointment in the United States, and the uncertain tenure of office, it is too often assumed that the engineer must necessarily represent a clique, or party, and serve, as nearly as he honestly can, the interests of the appointing power. But the public interest comes first with every right-minded man, and if the city engineer combines the necessary technical equipment and the force of character and knowledge of men here referred to, he may become the leader in matters relating to the public works of his constituency, as he should be, and his official usefulness will then become so generally recognized that nothing short of a municipal revolution can remove him. In other words, the city engineer who is properly equipped for his important duties cannot afford to be the servant of any clique or interest; he must lead, if the public interest is to be best served. As an illustration, a bit of experience may be related which came under the personal observation of the writer. A work of magnitude was being inaugurated in one of our largest cities under a city engineer who was very quiet in demeanor, but a man of wide professional reputation, and one who fully appreciated the responsibility and true dignity of his position. At the first meeting of the aldermanic committee in charge, several well-meaning members began to suggest changes and "improvements" in the general plans, and they talked on unchecked for some time until, in fact, they had assumed general charge of the engineer's duties and stood ready at all times to give him the benefit of their advice. When they had finished, the City Engineer arose and quietly remarked that they had commenced the construction of an important piece of public work which was to cost a large amount of money; the city authorities had placed him in position as its engineer, and held him responsible for its success, "And, gentlemen,



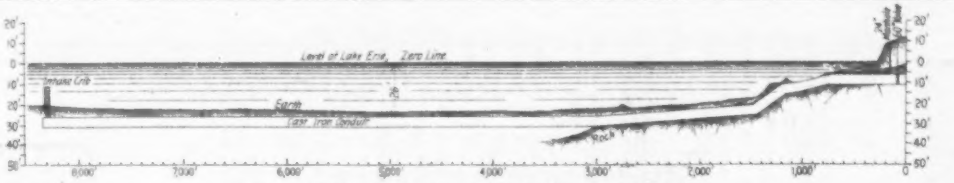


Level of Lake Erie. Zero Line.
Intake Crib
Earth
Cast Iron Conduit
Rock
8,000' 7,000' 6,000' 5,000' 4,000' 3,000' 2,000' 1,000' 0'
20' 10' 0' 10' 20' 30' 40' 50'

Fig. 2. Profile of Portion of Intake Now Being Put in.

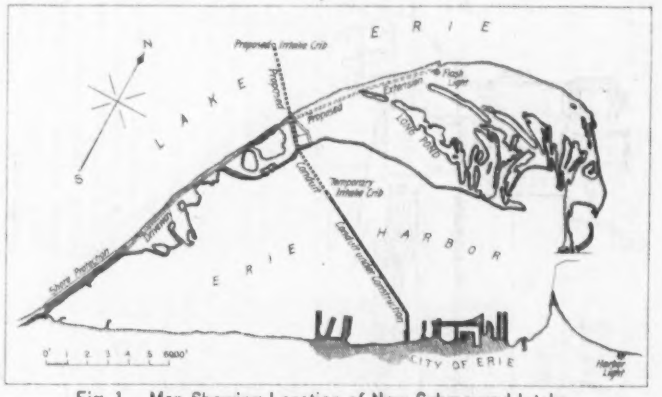



Fig. 1. Map Showing Location of New Submerged Intake.

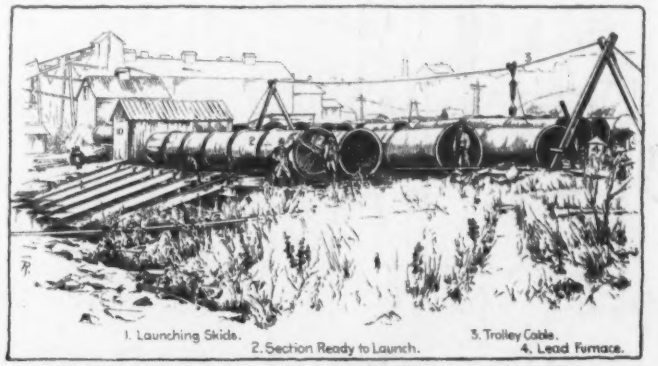



Fig. 4. Sketch Showing Method of Joining and Launching Pipes.

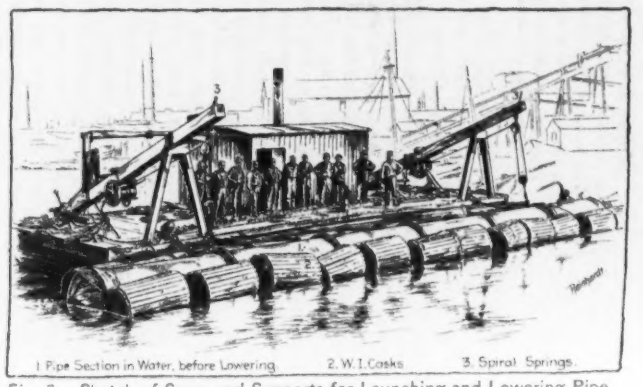



Fig. 5. Sketch of Scow and Supports for Launching and Lowering Pipe.

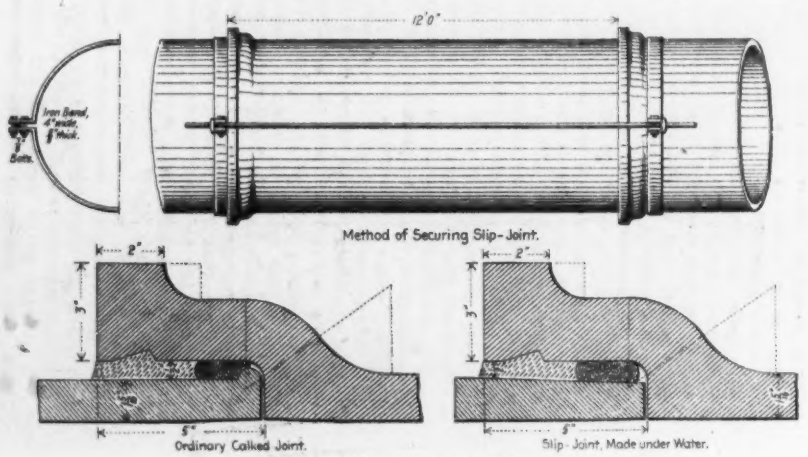
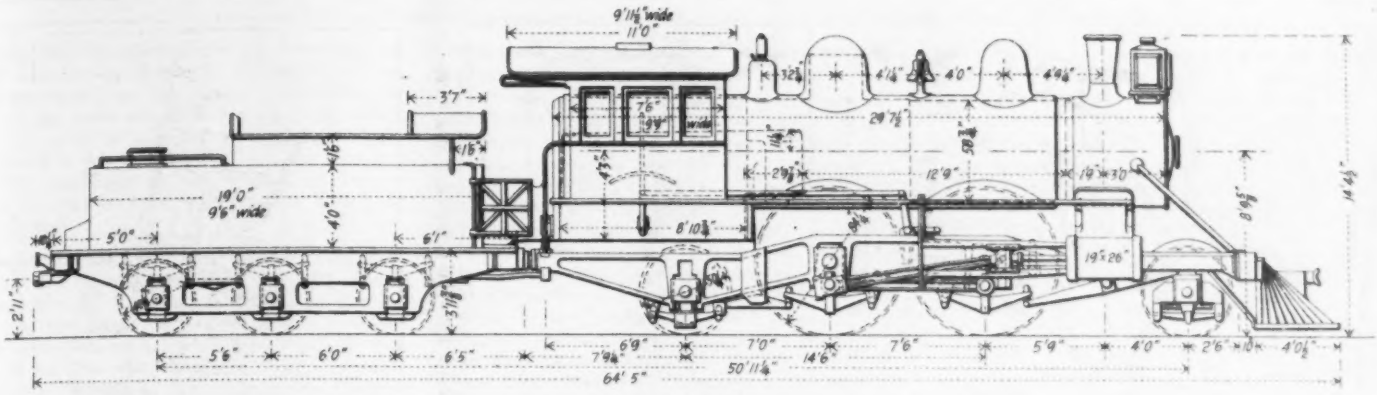


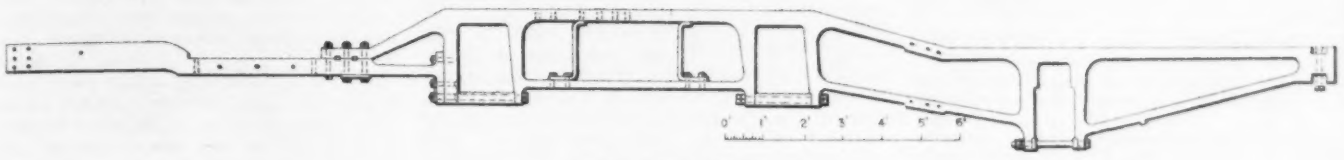

Fig. 3. Method of Joining Sections under Water.

# 60-in. Submerged Cast Iron Intake for the Water-Works of Erie, Pa.

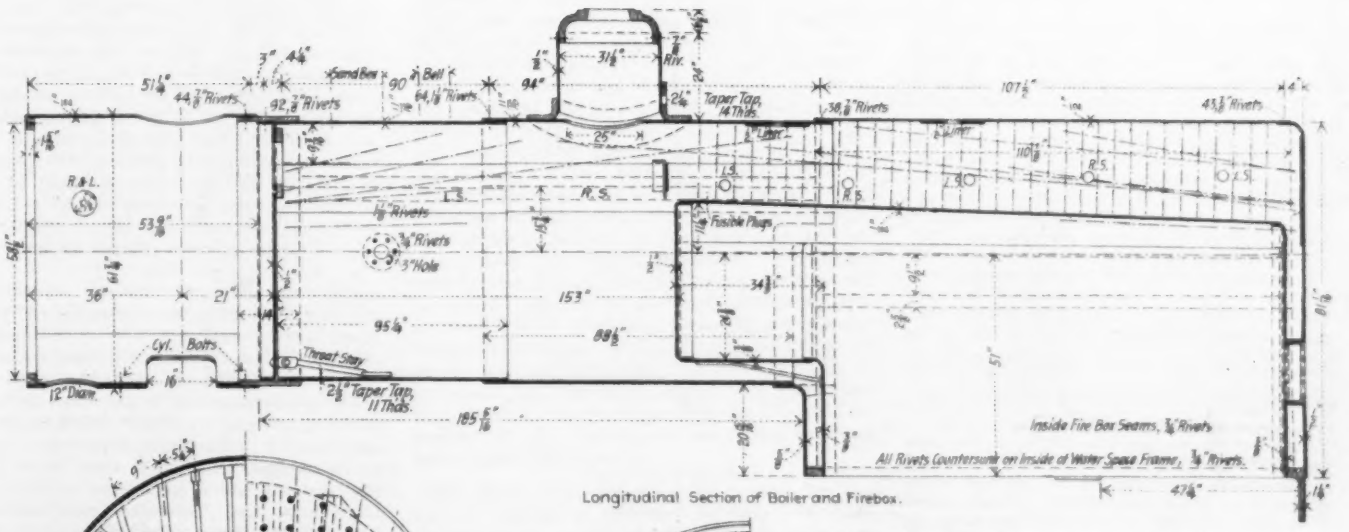
Walter C. Brough,
Designing and Constructing Engineer.



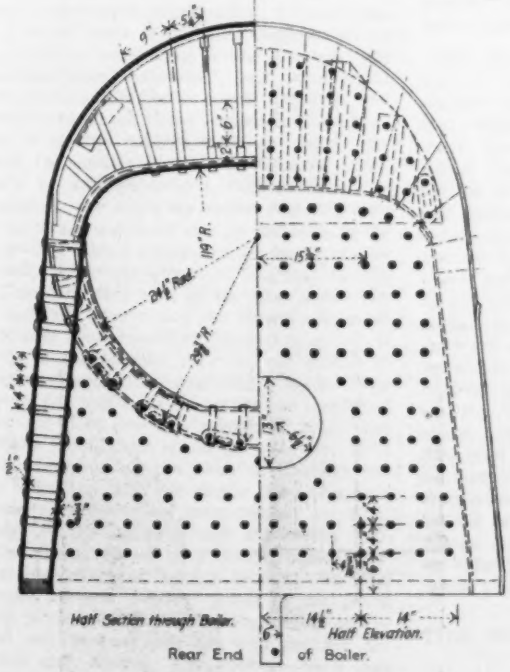

General Elevation.

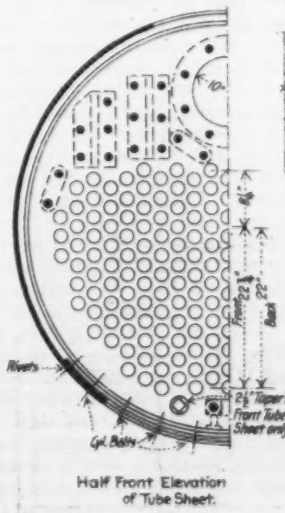


Side Elevation of Frame.

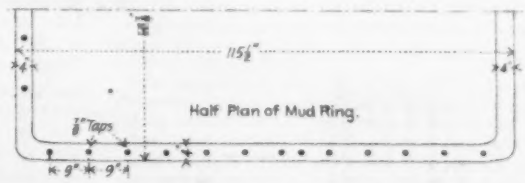



Longitudinal Section of Boiler and Firebox.

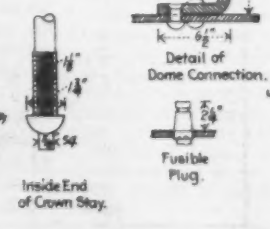



Half Front Elevation of Tube Sheet.




Half Plan of Mud Ring.



Inside End of Crown Stay.

Detail of Dome Connection.

Fusible Plug.

Sectional Plan of Dome.

Details of Boiler.

## Fast Passenger Locomotive, Chicago, Burlington & Quincy R. R.

Godfrey W. Rhodes, Superintendent of Motive Power. Baldwin Locomotive Works, Philadelphia, Pa., Builders.

CHAS. HART & SONS, LITH., 20 VESEY ST., N. Y.

I believe that it is better for all interests concerned that it be distinctly understood at the beginning, that I am the engineer, and that you have nothing to do with this feature of the undertaking by virtue of your official positions." That was all, but it was sufficient. From that time forward the City Engineer was engineer in fact as well as in name, and the work went on with little or no friction.

Attention is called to the excellent electric lighting franchise recently granted by the town council of Montclair, N. J., which is printed in another column of this issue. A more favorable franchise for an American town, and a more equitable and clear-cut one from the standpoint of all concerned, it would be difficult to find. True, the company must mind its P's and Q's if it is to make money under such a grant, but it has the astute financiers of the First National Bank of New York behind it, and has a wealthy suburb of New York as its field of operation. If it eventually secures the contract for the town lighting, as it, of course, plans to do, it will have a pretty income from that source alone.

The three most notable provisions of the franchise are as follows: (1) The rates for private lighting cannot exceed 20 cts. per 1,000 watts, with 5 per cent. off on all bills paid within 10 days, which is equivalent to gas at $1.90 per 1,000. It is to be noted that the company makes lamp renewals, furnishes meters and makes connections between house and street wiring free of cost to the consumer. (2) The franchise becomes positively null at the expiration of 15 years, which is a short term, as franchises go. (3) The town has the right to buy the plant at the end of any five years, the price to include nothing for the value of the franchise. The earning power of the plant, it is understood, may be taken into consideration in case of purchase, but on such a short-term contract this may be necessary, and is far different than in the case of a 50-year perpetual grant. Other excellent features in the franchise are so evident that they need no especial comment here.

The proposed Chicago ordinance to prevent "scamping" by contractors for street work, which is briefly described on the first page of this issue, appears more notable for its originality than its intrinsic merit. Analyzed carefully, it appears to be in effect an admission of the incompetency of the Department of Public Works of that city to do its work under its present organization; at least this is what it would mean if the chief engineer of, let us say, a railroad corporation should complain that his inspectors were habitually and successfully conspiring with contractors to deliver imperfect and faulty work or material to the company. The law of contracts is at the present time so clearly defined, and the correct practice of drawing specifications is so well understood, that habitual collusion between the city's inspectors and the contractors for municipal work can be due only to the participation of higher officials in the fraud, or else to a grossly defective system of carrying on the work. From the fact that in the case under discussion both the Mayor and the Commissioner of Public Works are advocating the ordinance, it is reasonable to assume that they are not parties to the collusion about which complaint is made. The real reason for inefficient inspection of municipal work appears to be due to a system of doing that work which is radically wrong in principle. The system is organized on the basis of partisan expediency in politics, and not on the basis of giving the people a businesslike management of their funds and of the improvements for which they pay. The Commissioner of Public Works is appointed to that office not because he is an engineer, but because he is a political power in the party in control of the administration; the inspectors are appointed not because they are well qualified for their work and honest, but because they are "friends" or "workers" in the same political party bailiwick. The contracts are let too often, it is to be feared, to the bidder with the largest "pull." With municipal work managed on a business basis, the proposed ordinance would be unnecessary. With such work run for the benefit of the party in power, such an ordinance can work no real improvement.

The uselessness of the ordinance will become apparent upon a little study of its provisions. Briefly summarized, it provides that the contractor, the suppliers of material, and the city inspector, shall each make a sworn statement of the amount and quality of the material supplied to the work. The city inspectors and the contractors are tacitly admitted by the ordinance to be in such firm collusion already that the Commissioner of Public Works is unable to prevent the city from being defrauded, so that nothing is actually gained by the ordinance, except to make the conspirators a little more work in successfully prosecuting their fraud. There then remains the supplier of material to check the contractor and inspector by his sworn statement. It is plainly evident that where the contractor and supplier of material are one and the same person—a very frequent thing in street-paving work—the conditions will not be much improved by this third-party oath. Again, where a supplier furnishes material for half a dozen jobs of paving in one order, and the contractor carries part of this material in stock, the sworn deposition of the supplier will aid the Commissioner of Public Works but little in placing fraud for any particular job. In any case, there only remain the difficulty and risk of adding a third party to the collusion or conspiracy. With every selfish interest to urge them to join and keep quiet, many suppliers of material are likely to do these very things. It must not be understood that we are classing all contractors, inspectors and suppliers of material as dishonest and prone to criminal dealings. Such a condition we believe to be far from the truth. There are, nevertheless, dishonest men engaged in city work, and it is these men that the ordinance is designed to frighten into honesty, regardless of the fact that the chief tools for its execution—namely, the inspectors and contractors—are themselves the criminals the ordinance is devised to catch. There is but one way to secure honest inspection, and that is to secure honest and efficient inspectors. To secure honest and efficient inspectors, the engineer must be able, without fear or favor of the "bosses," to employ and discharge his subordinates with no other end in view than their efficient prosecution of their duties. But partisan politics does not permit this, and the public will have to insist in a manner that the party leaders will understand that all public officers shall serve its interests, regardless of party expediency, before any real and lasting gain will be made.

The use of oil of less than 300 degrees fire test for car lighting is forbidden by the New York statutes under severe penalty; but an enterprising "Mail & Express" reporter discovered this week that the Manhattan Elevated R. R. is using "water-white" oil of 150° test for lighting all its cars instead of the "mineral sperm" of 300 degrees which the law requires. We have before received information of the use of low test oil for car lighting by some small local railways; but this is the first instance that has come to our notice of its use by so prominent and important a railway as the Manhattan Elevated. The railways of the country, it is fair to say, voluntarily adopted the higher test oil for its greater safety without legislative compulsion, so far as we are aware. The New York law, we believe, simply made compulsory a practice already established. The fact that the Manhattan road should run counter to the usual practice in this respect, and transgress a state law in addition, all apparently for the sake of saving a penny or two a gallon on the oil consumed, is such a notable illustration of its enlightened care for its passengers that it deserves a wide publicity.

## THE COST OF HAULING FREIGHT ON COMMON ROADS.

We have recently received from the office of Road Inquiry of the Department of Agriculture a statement giving the results of an investigation which it has recently completed into the cost of traffic on the country roads of the United States. As the figures given in this statement are of a good deal of interest and importance, if they are correct, we print it verbatim as follows, presenting the figures, however, in tabular form, instead of in the form adopted in the report, for convenience of reference.

With the aid of the Division of Statistics of the Department, reports have been gathered from about 1,200 counties, giving the average length of haul in miles, from farms to market or shipping points, the average weight of load hauled, and the average cost per ton per mile, and from this is deduced the average cost per ton for the whole length of haul.

| Section. | Averages. Length of haul, miles. | Wt. of load, lbs. | Ave. cost per ton hauled. | Ave. cost per ton-mile, cts. |
|---|---|---|---|---|
| Eastern States | 5.9 | 2,216 | $1.89 | 32 |
| Northern States | 6.9 | 2,136 | 1.86 | 27 |
| Middle Southern States | 8.8 | 1,869 | 2.72 | 31 |
| Cotton States | 12.6 | 1,397 | 3.05 | 25 |
| Prairie States | 8.8 | 2,409 | 1.94 | 22 |
| Pac. and Mtn. States | 23.3 | 2,197 | 5.12 | 22 |
| United States | 12.1 | 2,002 | $3.02 | 25 |

With these data it becomes possible to obtain approximately the total cost of the entire movement of farm products and other classes of materials over country roads.

Taking the census returns of the farm products of the United States for 1890, adding 8% for the increase in five years corresponding to the increase in the previous 10 years, finding the weights of the various articles and reducing the total to tons of 2,000 lbs., we have a total weight of farm products for the year 1895 of 219,824,227 tons.

No information is available as to the amount of hay and grain consumed upon the farms where they are raised, nor is there any return of large classes of materials moved over the country roads, among which are: Building materials, including stone, lumber, brick, lime and sand; fencing materials; road materials—gravel, stone, etc.; fertilizers—commercial and domestic, lime and plaster; coal, ore and metals; straw and fodder; home-killed meats and animals driven to market; garden products and grass seeds; poultry and eggs; merchandise; farm machinery.

It is deemed safe, however, to offset these various items against home-consumed hay and grain, and so to count the equivalent of the total farm product as being hauled on the public roads.

The Division of Forestry of the Department furnishes an estimate of forest products as follows:

| | |
|---|---|
| Annual cut of fuel | 18,000,000,000 cu. ft. |
| Mill product | 5,000,000,000 " " |
| Total | 23,000,000,000 cu. ft. |

The Chief of the Forestry Division makes the very safe estimate that one-fourth of this total, or 5,750,000,000 cu. ft., is hauled over the public roads. Adding timber used for railroad construction, 485,000,000 cu. ft., makes a total of 6,235,000,000, which, at 30 lbs. per cu. ft., gives 93,525,000 tons of 2,000 lbs. Adding this to the total farm product, gives 313,349,227 tons, which at the average cost above stated, $3.02 per ton, makes a grand total for the annual cost of haulage on the public roads of $946,414,665.54.

The immensity of this charge will be best realized by comparing it with the values of all farm products in the United States for the year 1890—$2,480,170,454, which values have probably diminished since that date.

What portion of the total cost of haulage is chargeable to bad roads can be better ascertained when the report from our consuls abroad regarding the cost of haulage on good roads is received. This information has been asked for from the State Department by the Secretary of Agriculture in a recent communication.

The increase in cost of haulage actually done is by no means the only loss by bad roads. The loss of perishable products, for want of access to market, the failure to reach market when prices are good, and the failure to cultivate products which would be marketable if markets were always accessible, add many millions to the actual tax of bad roads. Moreover, the enforced idleness of millions of men and draft animals during large portions of the year is a loss not always taken into account in estimating the cost of work actually done.

Information already in possession of the Office of Road Inquiry indicates that, all things being considered, nearly, if not quite, two-thirds of this vast expense may be saved by road improvement, and this at a total cost not exceeding the losses of three, or, at the most, four, years by bad roads.

Certainly if the figures above given are correct, and if it actually costs a third of the total value of all products of the country's farms and forests to transport them, not to the consumer, but only to the point of shipment by rail or water, the fact

is of the greatest economic and industrial importance.

Let us get some idea of the magnitude of this enormous sum of $946,414,665.54, which is given as the total cost of haulage on the public roads. We can best do so by making some comparisons. Suppose, in the first place, we lop off the "fifty-four cents" together with some of the other odd figures, which only serve in the present case to confuse. We have then 946 millions of dollars as the alleged annual expenditure for haulage on the common roads. Last year the total gross earnings from both freight and passenger traffic of all the railways of the United States was 976 million dollars. From freight traffic alone the railways earned only 700 millions of dollars. Does it seem really probable that it costs 1⅓ times as much to carry on all the traffic over common roads as to handle all the railway freight traffic of the United States?

Let us make the comparison still more clear. Of the total 700 million dollars which the railways of the United States earned in freight traffic, a very large proportion was on freight which is never hauled over common roads. For example, almost the entire mineral product of the country, including 170 million tons of coal, 12 million tons of iron ore, and all the multitude of other minor products are almost invariably loaded at the mouth of the mine or quarry directly upon railway cars, on which they are carried to their destination. Suppose we deduct from the railways' total freight receipts of 700 million dollars the amount received from freight which is not hauled over common roads, including the bulk of all ores and minerals, a large proportion of the manufactured articles (there are few large factories nowadays which do not have switches running into their yards), and practically all the imported goods, which are loaded from the steamer or the importer's warehouse directly into cars. How large a proportion will be left as the receipts from freight which is hauled over common roads to the railway station? The estimate is a difficult one to make; but, remembering that imported and manufactured goods constitute high-class freight, on which much higher rates are paid, and remembering also that the total value of all mineral products at the place of production in 1894 was 550 million dollars, it seems reasonable to believe that some 400 million dollars may be a fair estimate of the railways' receipts from traffic hauled over common roads.

We are now ready to make our comparison and to inquire whether it is likely that if 400 million dollars represents the total receipts of the railways from hauling farm products, the cost of hauling these products to the railways was 946 million dollars?

There is another and still more instructive way to check these remarkable figures from the Agricultural Department. Supposing it to be true, as is alleged, that $946,414,665.54 is the annual cost of haulage of freight over common roads, a very pertinent inquiry is, Who receives this vast sum of money? Manifestly only a mere trifle of this is paid to teamsters who make a business of hauling freight. Everybody knows that the business of "freighting" has practically disappeared, except in remote districts, and that the total amount paid to men who make a business of carrying freight on the highways is but an insignificant trifle compared with the freight earnings of all the railway lines of the country. We must conclude then, that, practically all of this 946 million dollars is actually not paid out at all in money. Farm products are in practically every case drawn to the railway station by the farmers themselves, with their own horses and wagons; and the question then is, What is the cost to the farmer of doing this work?

The Office of Road Inquiry proposes to determine this cost by computing the cost of hauling a ton a mile, and multiplying it by the total ton-miles of traffic over the common roads. Is this a correct method? Should not the cost to the farmer rather be measured by the actual expense which he incurs in hauling his products to market? Emphatically it should be, for the whole object and purpose of this inquiry is to ascertain how much the farmer can afford to pay for better means of transportation to the railway.

What, then, does it cost the average farmer to haul his products to the railway station to shipment? What extra bills must he pay which he would not pay if an electric freight railway ran past the door of his barn or granary? Does he keep any extra horses to haul his products to market? Manifestly not. He keeps his horses to do his farmwork. Hauling grain, the bulkiest crop save hay which is shipped from the farm, is but an insignificant fraction of the year's work of his teams. Nor does he hire any extra men for this work. The farmhands, who are hired by the month, do this work at a time when, in nine cases out of ten, they would otherwise be idle. Of course, we are speaking now in a broad way; there are exceptional cases and exceptional localities where a long distance from the railway station makes the cost of hauling such heavier products as hay, grain or potatoes something of a burden to the farmer. In general, however, the fact is that the cost to the farmer of hauling his own products to the point of shipment is always less, and in most cases very greatly less, than the price at which any one making a regular business of freight hauling over common roads could afford to do the hauling.

And now let us turn to the figures for the cost of hauling per ton-mile over common roads, which the "Division of Statistics" of the Agricultural Department has collected with such alleged care. Are these figures, which set down the average cost for the whole United States as 25 cts. per ton-mile, worthy of any credence?

By a curious coincidence, on the same day that the bulletin giving the above figures was received, our attention was called to an item in a San Francisco newspaper, which we noted editorially last week, giving a detailed account of the starting of freight wagons to compete with the Southern Pacific Ry. on shipments from San Francisco to the San Joaquin valley. These shipments by wagon appear to have been made at a rate of about 3½ cts. per ton-mile. This is probably a somewhat lower rate than could be permanently maintained for the movement of freight over common roads. But there is a very large gap between 3½ cts. per ton-mile and 22 cts. per ton-mile, which the bulletin above quoted alleges to be the average cost on the Pacific Coast. Just to see on which side the truth is likely to lie, it is worth while to make a rough estimate.

Suppose a team of four horses is able to haul a load of three tons 20 miles per day, working 275 days in the year.

| | |
|---|---|
| Cost of horses, harnesses and wagon | $650.00 |
| Interest (6%) and depreciation (15%) per year | 136.50 |
| " and depreciation per working day | .50 |
| Feed and care of horses per day | 1.45 |
| Driver per day | 1.75 |
| Total cost per working day | $3.70 |

Then we have as the cost per ton-mile $3.70 ÷ 60 = 6 cts. and a small fraction. Making due allowance for the profit charged by the freighter, it would seem that 8 to 10 cts. per ton-mile is a figure at which plenty of men can be found to undertake freight hauling over common roads in almost any part of the country.

In view of the attention which is being paid nowadays to highway improvement, the extension of electric railways into country districts, the building of "light railways," etc., this question of the cost of hauling over common roads is one of much importance, and it is one, moreover, on which very little accurate and reliable information is to be had. There must be many among our readers who could give from their own experience figures showing the actual cost per ton-mile of hauling freight over common roads for considerable distances, and we shall be pleased to receive such figures for publication.

As we have already pointed out, however, even if the very high figures of cost of haulage per ton-mile which the Office of Road Inquiry puts forth were correct, they are wholly inapplicable to the conditions under which farm produce is actually hauled. The estimate that the total cost of haulage over common roads is nearly a billion dollars per annum must be set down, we believe, by any impartial critic as a wild exaggeration. Such ridiculous statements must injure rather than aid the cause they are put forth to serve.

## LETTERS TO THE EDITOR.

### SPEED OF THE U. S. CRUISER "MINNEAPOLIS."

Sir: Your issue of Nov. 21 contains a statement, on p. 337, concerning the highest speed ever attained by a warship, to which I beg to call your attention in the light of that which you have formerly published relating to the U. S. triple-screw cruiser "Minneapolis." Your issue of July 19, 1894, p. 43, contains the following statement:

The triple-screw cruiser "Minneapolis" attained a speed of 25.2 knots during her trial trip of 88 miles at sea, and her average speed was 23.073 knots.

It should be remembered that this speed, expressed in knots per hour, is for the average speed (corrected for a tidal correction of 0.14139 knots) over the total trial distance of 87.936 knots, for the total time on course of 3 h. 49 min. 02.28 sec. The above average speed you place over against the one-mile spurts of the twin-screw cruiser "Buenos Aires," the best measured-mile run of which was made in 2 min. 33 sec., or at a speed of 23.529 miles per hour. Are these statute or nautical miles? If nautical miles, why not state them as knots, as formerly in your account of the trial of the "Minneapolis"? It is apt to lead to erroneous conclusions.

The "Minneapolis" also spurted a little, notably so on her run south, from Cape Porpoise to Cape Ann. It was not for one mile alone, but for a distance of 6.295 knots, which she covered in 15.73 minutes, or at the average (uncorrected for tidal error), for this period of the run, of 24.01 knots per hour.

These figures, from the official contract trial of the "Minneapolis," show that the "broom" is not to be taken from her masthead just yet.

Very truly yours, Wm. S. Aldrich,
Mem. Soc. Naval Architects and Marine Engrs.
West Virginia University, Morgantown, W. Va.,
Nov. 23, 1895.

(We are obliged to our correspondent for calling our attention to this matter. Our note in reference to the "Buenos Aires" was extracted from an extended account in our English contemporary "Engineering," which states that "the ultimate result" (of the 'Buenos Aires' trial) "was a speed, for the whole six hours, of 23,302 knots; a performance which puts the "Buenos Aires" at the head of the sea-going ships of the world for speed of steaming."

But, according to our contemporary's report, this record speed, on the strength of which the championship of the world is claimed, was not made over a measured course, but by running the ship over a measured mile for six times and "thus getting the data, by means of the revolutions, necessary to determine the ship's speed in the straight-out and home run" of six hours, to quote our contemporary verbatim. In the runs over a measured mile the "Buenos Aires'" average speed was only 22.72 knots. We are now asked to believe on the evidence of the revolution counter in the engine room that the average of a six-hours' run was nearly half a knot better than these runs over the measured mile. We question whether the relation between the engine revolutions and vessel speed in any new vessel on her trial trip can be so accurately determined as to warrant reliance on a speed record obtained in such a manner.—Ed.)

## NOTES AND QUERIES.

R. M., Mobile, Ala., asks where he can buy paper condenser ferrules. Address Wheeler Condenser & Engineering Co., 39 Cortlandt St., New York.

J. C. M. asks: "Has the North River Tunnel been abandoned permanently, or only temporarily, and who is now in charge of it?"

We fear the wisest man on earth could not answer the first of the above questions. If more money can be raised, work will doubtless be resumed; if not, the abandonment can be described as permanent. According to press reports, at a recent meeting of the bondholders in London a plan for readjusting the company's affairs, and raising money to resume work, was discussed, but we believe nothing has been definitely decided on. Roberts, Lubbock & Co., a London banking firm, are the chief representatives of the English bondholders; Mr. John R. Dos Passos, of New York city, is the counsel for the Tunnel Construction Co., and Pearson & Son, the English contractors who are just completing the Blackwall tunnel under the Thames, have a large interest in the tunnel for the work which they did upon it. The past history and engineering features of the tunnel will be found in our issues of Aug. 7, Oct. 9, Oct. 23, 1880; Sept. 2, 1882; March 15, 1890; June 16 and Sept. 15, 1892.

## A FEW DAYS IN CONNECTICUT.

(Editorial Correspondence.)

The writer has never lived in New England, nor have any of his ancestors, and he has therefore no bias toward that portion of our country on account of personal association, but he never travels in it without a sense of pride that it is a part of the United States and of profound admiration for its people. It is the one place of all others that the American who does not live in New England should visit, and visit often. Its varied and beautiful scenery, its climate (except upon unfavorable occasions), its architecture, old and new (here we find the real old Colonial), its excellent roads and well-paved streets, and its rapid transit (trolley cars everywhere) all delight the physical senses, while for the student of sociology there are endless object lessons to show how the people are grappling with all the problems of civilization. How the early settlers overcame the difficulties presented by an inhospitable climate and a sterile soil is a matter of history. In recent years New England has had to face the agricultural competition of the West, which has depopulated its farms, and in many sections caused them to be abandoned; it has seen its manufacture of raw iron and steel almost entirely destroyed by similar competition; its native workmen have largely emigrated to the West, and their places have been filled by French Canadians; its whaling vessels plow the seas no more since the advent of petroleum; its shipyards for the building of wooden vessels have decayed since the introduction of iron steamers and the building of transcontinental railways, and now its cotton manufacture is threatened by the competition of the South. But in spite of all these untoward events New England is still a land of progress. It is still advancing in population, in wealth, and in the comforts of civilized life. In many respects it is like old England. Like the latter, it imports its chief supply of food and of raw material for manufactures; a highly-diversified manufacturing industry gives employment to a dense population; the products of this industry it sends all over the world, and besides this, much of its revenue comes from the investment of capital beyond its own borders.

In the mechanical engineering line also New England is much like old England. There exist side by side the new and the old, progress and the lack of it, enterprise and conservatism. It is the land of steady habits in machine building as in everything else. Forty years ago the New Englander built good steam engines, lathes, planers, etc., and he is building them yet. They were so good then that there was not much room for improvement, but to-day they are built stronger and run faster to satisfy modern demands. Much of the machinery is still built in old-fashioned shops, poorly lighted, and equipped with ancient tools. Yet some of these shops which show such an apparent lack of enterprise have comfortable bank accounts and no bonded debts; and when trade depressions like those of 1873-9 and of 1892-4 came along, although they may shorten hours and diminish their working forces, they do not fail, while their more enterprising rivals, with modern shops and no surplus funds, too often go to the wall.

From a number of conversations had with different manufacturers of machinery and materials, some ideas were gained concerning the peculiar New England conservatism which are worth noting. Learning of the failure of one concern which had a splendid reputation for the character of its special products, I asked the cause of its failure. "The big head," was the reply. "It expanded too much. If it had been content with a fair share of the trade in the one thing that it could do well it might have been rich." Another instance was given of a famous concern with over a million of invested capital, but whose stock pays very small dividends. It was stated that its founders would be far richer than they are to-day if they had confined their energies to the single class of machines with which they established their reputation, and had not attempted to cover the earth with every kind of machine tool. One concern that makes a very limited line of tools, but has an excellent reputation and over 40 years' standing, was found to have a very old-style shop, with but a small working force, not a quarter of the shop's capacity, but with quite a large stock of finished and partly-finished tools waiting for orders. On mentioning to another manufacturer the apparent lack of progress and of prosperity in that shop, he said: "Yes, but that shop has always made money, and has plenty of money in the bank. If it had been more enterprising it might not have had any." Still another shop, making a single specialty, an old-time, dingy sort of place, was found very busy, and claimed to be overcrowded with orders. "Why don't you increase your capacity then and build a large and modern shop? "We are making enough money now, and know when to leave well enough alone," was the answer.

The Norwalk Iron Works Co., South Norwalk, Conn.—The term "iron works" in New England does not always mean a place where iron is made, but it may be either a foundry and machine shop, or a place where wrought iron or steel is formed into finished shapes. The Norwalk Iron Works Co. has a foundry and machine shop, but its work is chiefly confined to one line of business—that of making air compressors. Since the natural gas in our Western country has ceased to flow from the wells with the tremendous pressures that it had a few years ago, gas compressors have been introduced to help it come out of the wells and to push it along through the pipes, and this company is now devoting a good deal of its energy to that problem. The usual form of the Norwalk air compressor is well known, the system for most locations being that of compound compression in two tandem cylinders with an "intercooler," a horizontal, cast iron pipe filled with small copper tubes through which water is circulated between. The air is received into the large inlet cylinder through positive motion rotary slide valves, similar to those of a Corliss engine, and compressed to about half the final pressure desired. It then passes through the intercooler into the smaller cylinder, where it receives the remainder of the compression. The steam cylinder, placed tandem with the two air cylinders, has a cut-off valve riding on the main valve, the cut-off being adjustable by a hand wheel. Where economy of steam is of importance, the steam engine is also compounded. The general availability of compressed air as a means of transmitting power to a distance is so great, and has recently become so well known, that if electric transmission had not been introduced till the present time, it is probable that compressed air would have found a vastly greater field of usefulness than it has at present; but electric power, with its many points of superiority, has limited the field of compressed air. Yet there are still a great variety of purposes for which compressed air has the advantage over electric power, and the business done by the makers of compressors seems to be steadily increasing. Certainly the Norwalk Works shows no signs of suffering from the introduction of electric power, and they are now very busy on orders. The following list, taken from their catalogue, shows the great variety of uses for which compressed air is still found available:

For power transmission, for agitating liquids, for pneumatic hoists, for sand blasts, for feeding oil fires, for riveters, for hat presses, for liquefying oxygen, carbonic acid and other gases, for drying pulp, for filling balloons, for crushing stone, for firing dynamite guns, for pneumatic locomotives, for traversing gun carriages, for torpedo boats, for refrigerating, for chipping machines, for pumping acids and other liquids, for pneumatic molding machines, for freezing quicksand in excavations, for pneumatic tramways, for luminating cars, for transmitting natural gas, for painting buildings, for testing pipes, for throwing switches, and setting railroad signals, and for many other purposes.

A special catalogue of gas compressors states that the company has compressor plants throughout the gas fields of New York, Indiana and Ohio, pumping about 28,000,000,000 cu. ft. of gas per year. One plant, at Redkey, Ind., supplies pipe lines leading to Lima, St. Mary, Dayton, Springfield, Piqua, Recovery, and other towns in Ohio, forcing the gas through a system of about 150 miles of 10, 8 and 6-in. pipes. The plant was completed in 1894, and consists of four compressors. During the past winter they pumped 2,000,000,000 cu. ft., the pressure at the pipe at Redkey being 300 lbs.

### Bridgeport.

Bridgeport is one of the most flourishing cities in New England. Its growth in recent years is almost entirely due to the increase of its manufacturing industries. The following figures show its growth compared with that of the county in which it is situated:

| | Fairfield county. | Bridgeport. | Rest of county. |
|---|---|---|---|
| 1890 | 150,081 | 48,866 | 101,215 |
| 1880 | 112,044 | 29,148 | 82,896 |
| Increase | 38,037 | 19,718 | 18,319 |
| Increase, % | 34.0 | 65.6 | 22.1 |

The present population of Bridgeport, as estimated from the school enrollment, is 58,860. Some statistics published by the Board of Health give the following:

Area of city, 14.63 square miles; miles of streets, 194; graded and paved, 57; miles of electric street railway, 75; miles of water main, 75; miles of public sewers, 53; number of corporations engaged in manufacturing, 306; different branches of manufacturing, 212; capital invested, $17,539,680; wages paid yearly, $3,686,346; market value of finished products, $20,459,022. Death rate per 1,000 for 1894, 15.2.

Garbage Utilization.—A new garbage utilization works has just been started at Bridgeport for the treatment of garbage and converting it into a fertilizer. The process is one originally invented by Mr. E. Holthaus and improved by Messrs. Cyrus Currier & Sons, of Newark, N. J. The plant is an experimental one, of the capacity of 50 tons of garbage per day. The contractors receive from the city 34 cts. per ton for disposing of the garbage, the city delivering it at the works. At the time of the writer's visit only about 10 tons per day were being collected, but the amount will, of course, be greatly increased in summer time.

Bridgeport Factories.—Bridgeport is an excellent location for manufacturing, being only 56 miles from New York, on the main line of the New York, New Haven & Hartford R. R., and on an excellent harbor opening out into Long Island Sound. The manufacturing establishments are mostly strung along the railway for a distance of nearly two miles. Several lines of electric street cars give rapid transit between the factories and the business and residence portions of the city. According to the report of the Board of Health above quoted, there are no less than 306 corporations engaged in manufacturing ,representing 212 different branches. Of course most of these works are small, but there are quite a number of very large works, whose products are well known all over the country. A few only can be mentioned:

The Farist Steel Co. has a crucible steel works, with a 24-pot Siemens gas melting furnace. Product, crucible steel rolled and hammered; also rolled and hammered open-hearth steel from purchased ingots, and spiral and elliptic railroad springs. Established in 1868.

The Ashcroft Mfg. Co. and the Consolidated Safety Valve Co. are concerns owned chiefly by the firm of Manning, Maxwell & Moore, of New York. They have a large new factory, and manufacture a variety of steam engineers' specialties, such as steam and other pressure gages, indicators, "pop" safety valves, etc.

The Wheeler & Wilson Sewing Machine Co. is one of the old reliable sewing machine concerns which has survived all the vicissitudes of the trade and is still flourishing.

The Union Metallic Cartridge Co. started in 1866 in a small way, and the works now cover several acres of ground and employ over 1,000 men.

The Salt's Textile Mfg. Co., manufacturers of velvets, plushes and seals. This concern occupies the fine old factory of the Howe Sewing Machine Co., which a few years ago succumbed to the competition of its rivals. The concern is an offshoot of the famous English works of Sir Titus Salt, Sons & Co.

Eaton, Cole & Burnham Co. are manufacturers of valves, brass and iron pipe fittings, etc. A large and long-established works.

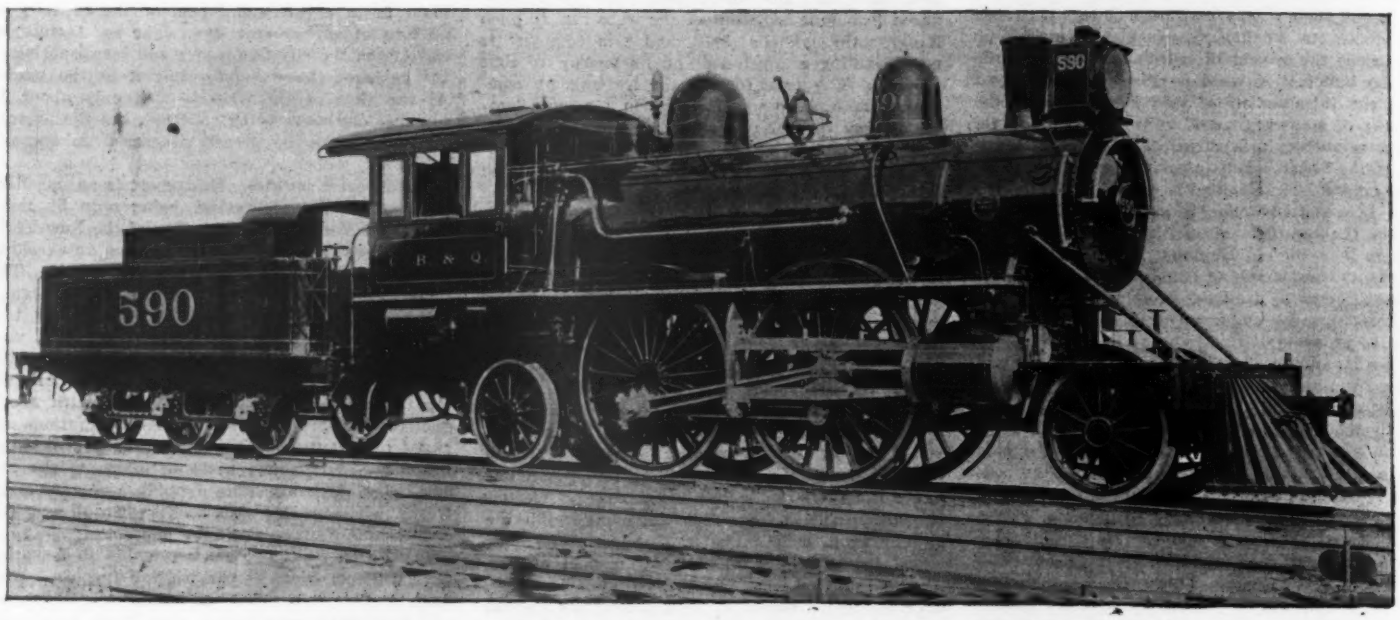
The Bullard Machine Tool Co. has a large four-story old-style machine shop, with a new one-story addition, with galleries in the modern style, and fitted up with overhead traveling crane and all the latest appliances. A large line of machine tools is made in these works, but they are now chiefly

engaged on their leading specialties of vertical boring and turning mills, engine lathes and turret machines. The heaviest turret machine has a swing of 32 ins., and the bed is 12 ft. long. The spindle has a hole 3⅝ ins. in diameter, and the hexagonal turret has six 3½-in. holes, arranged to permit a bar to pass entirely through the head.

The Bridgeport Malleable Iron Co. has an establishment covering several acres of ground. It makes not only malleable iron castings, but also fine gray iron castings, especially small and very thin castings.

The Smith & Egge Mfg. Co. makes a line of hardware specialties and light metallic goods generally. It was established in 1874 and now has a factory comprising a four-story building 100 × 100 ft., with several smaller buildings, and employing 150 to 200 men. One of its products is the Giant metal sash chain, a weldless chain formed by automatic machinery from metal strips. They are contractors with the U. S. Government for mail locks and make a variety of padlocks, one of the latest being a padlock for bicycles.

The Bridgeport Copper Co. has a very large works for refining copper and copper matte brought from Montana. Both the reverberatory furnace and the electrolytic methods of refining are used.




COLUMBIA TYPE OF EXPRESS LOCOMOTIVE; CHICAGO, BURLINGTON & QUINCY R. R.
Baldwin Locomotive Works, Builders.

The Deoxidized Bronze Co. has a large foundry for the production of the various grades of bronze, brass and babbitt metal; also "deoxidized" copper in ingots, bars, etc. The "deoxidizing" is a process designed to remove the oxide of copper which is a commonly-found detrimental ingredient of cast copper and of many alloys high in copper made from it.

The Waldo Foundry is another finely-equipped brass and bronze foundry. It makes a specialty of aluminum bronze, and has been highly successful in casting this alloy into a great variety of forms, which is well known to be at the same time the best in physical qualities, non-corrosiveness, etc., and the most difficult to cast of all the alloys of copper, unless extraordinary precautions are taken. It has a thoroughly-equipped chemical laboratory for analyses of metals and products.

## New Haven.

New Haven is 18 miles beyond Bridgeport. It is a larger city than Bridgeport, has a similar good harbor and railroad facilities, but is more famous as the site of Yale University than as a manufacturing town, although it contains a great number of factories, large and small.

The Sheffield Scientific School.—Yale University is, of course, the institution for which New Haven is most famed. Of the many schools in the university, the Sheffield Scientific School holds high rank. The number of students now in the school is 590, divided as follows: Freshmen, 150; juniors, 207; seniors, 167; graduates, 52; special students, 14. The small number of freshmen as compared with the juniors and seniors is due to a recent advance of the requirements, which forces back into the preparatory school a number of studies formerly given in the freshman class. The entrance requirements are now quite advanced, and include a considerable amount of Latin, either German or French, with algebra, plane, solid and spherical geometry and trigonometry. The school has a splendid equipment of buildings and laboratories, is well endowed, and has a large corps of instructors. There are 15 professors on the governing board and 42 additional assistant professors and instructors. The civil engineering department is in charge of Prof. A. Jay Du Bois, well known as the author of a treatise on graphical statics and other works. Mechanical engineering is in charge of Prof. Chas. B. Richards, who was at one time Superintendent of Colt's armory in Hartford, Conn., and more recently with the Southwark Foundry, of Philadelphia. Although Professor Richards is an eminently practical man, he believes in the student giving his whole time in the college to education in the fundamental principles of engineering as distinguished from shop practice, which he can obtain after graduation. The Sheffield school, unlike most of the schools of mechanical engineering, therefore does not have a course in shopwork. It has, however, a mechanical laboratory for testing materials, which is used in part of the instruction.

The Boardman Manual Training High School.—New Haven has now one of the finest manual training schools in the country. The building, erected in 1894, was the gift of Mrs. Lucy H. Boardman, who donated $70,000 for the purpose. The school is run as a branch of the public school system. The tuition is free to all those whose parents or guardians reside within the limits of the school district. Others are required to pay $60 per year. The school day is divided into eight periods of 45 minutes each, two of which are devoted to manual training and the remainder to academic studies. The minimum age of entrance is 14 years and the course is three years. It is expected that graduates will be qualified to enter the junior year of the Sheffield Scientific School as special students in either of the three engineering departments or in the chemical and biological departments. The manual training equipment is very complete and of the highest class. It includes boilers and engine, machine shop, blacksmith shop, carpentry and pattern shop, molding and casting room, electrical laboratory, etc. A thorough course in mechanical drawing is given, and there is laboratory work in physics, chemistry, mineralogy and botany. For girls the manual training work includes cookery, dressmaking, millinery, wood carving and clay modeling. The school was organized in September, 1894, with 200 pupils. It has a capacity for about 400. The teaching force at present consists of Prof. Thomas W. Mather, Principal, and 16 assistants. To those who are considering the establishment of manual training schools in other cities, we would strongly recommend a visit to this school in New Haven. It exemplifies the most advanced ideas of the new education.

New Haven Manufacturing Industries.—The manufacturing industry of New Haven is of a highly diversified character. It has some large factories of world wide reputation, such as the hardware factory of Sargent & Co. and the works of the Winchester Repeating Arms Co. It is a leading center of the manufacture of fine carriages, and has a great number of small concerns which make certain parts of carriages, such as axles, wheels, bent wood, tops, bodies, springs, hardware and supplies. There is a rolling mill—the New Haven Rolling Mill Co.'s—which chiefly re-rolls scrap iron. There are six foundries, a great number of machine shops, mostly small, and about 40 small concerns making hardware specialties. Two firms make drop presses—the Miner & Peck Mfg. Co. and the Belden Machine Co.

The New Haven Mfg. Co. is a very old concern, which makes a specialty of ordinary machine tools, such as lathes, planers, etc. Its standard form of planer has long been one of the best known in the trade. It is now putting a new engine lathe on the market with the latest improvements for convenience of operation. It has one leading screw reserved for screw cutting, and another for ordinary work.

The Bigelow Company, established in 1865, has one of the largest boiler works in New England. It is located on the harbor at the eastern end of the town. Besides boilers of a great variety of forms, it makes foundry cupolas, dryers, coolers and digesters for packing houses and garbage-utilization plants, vulcanizers, tanks and other plate ironwork. One of its specialties is the Manning vertical tubular boiler, and it also makes Heine water-tube boilers for the Heine Boiler Co., of St. Louis.

The National Pipe Bending Co. has a works adjoining the Bigelow Works. Its leading specialty is the National feed-water heater, which consists of a cylindrical plate-iron tank enclosing a set of concentric copper coils, through which the water is passed. It also makes bent coils of all shapes and sizes of brass, copper and iron pipes for stills, vacuum pans, dryers, etc.

The McLagon Foundry Co. is an old concern

which does a general iron foundry and machine business. Among its specialties are the New Haven horizontal and vertical brick machines and general brick-yard equipment.

The Eastern Machinery Co. is a new concern just starting, a development of the increasing business of the McLagon foundry and owned by the same parties. It is about to take over the entire machine department of the foundry company, which will continue the foundry business under the old name. It will add to the brick machine business the manufacture of the Frisbie friction clutches and elevators, formerly made by the Frisbie Elevator Co., which recently suspended operations.

### Meriden.

This is a typical New England manufacturing town of 21,600 inhabitants, according to the last census. Its leading industry is silverplated ware, the Meriden Britannia Co. being the leading concern. It also has the Meriden and the Wilcox Silver Plate companies, the Meriden Bronze Co. and the Bradley & Hubbard Mfg. Co., manufacturers of lamps, chandeliers, etc.; the Meriden Cutlery Co., table cutlery; Miller Bros.' Cutlery Co., pocket cutlery; Parker Bros., sporting guns; Chas. Parker & Co., makers of the Parker vise; the Wilcox & White Organ Co., the Eolian Co., makers of the Eolian piano, etc.

The Meriden Machine Tool Co.—The writer expected to find this a large and imposing concern, making a great variety of machine tools, but instead found it to be a rather small shop, making only one leading article, known as a forming lathe. It makes this machine in considerable variety, however, adapted for a great variety of purposes, and it makes it so well that it has obtained a wide reputation. The forming lathe is a mechanical wonder in the speed with which it does its work. It is used for turning small articles, such as handles, cocks, tops for pepper and salt dishes, covers of hollow-ware, etc. The tool is a bar of steel of the width equal to the axial length of the portion of the piece to be turned, and shaped on its upper surface to the exact form of the piece. Pieces are chucked in a chuck placed in the lathe spindle and the tool is moved forward on the slide rest all by a single movement of one lever. The first part of the motion of the lever tightens the chuck, and a further movement brings the forming tool forward under the work and turns it to shape, after which the tool drops sufficiently to clear the work during the reverse motion of the lever, which motion loosens the chuck and raises the tool at the proper time and in position for another cut. All operations are performed without stopping the lathe. In soft metal, such as white metal for silverplating, the rapidity of the operation is extraordinary. A piece like the top of a mustard bottle can be turned in about 10 seconds, and the surface left in perfect condition for plating. Besides the ordinary forming lathe modifications are made for special purposes, including a turret attachment. The company also designs and builds special tools for the rapid production of brass goods, silverplated-ware and casket hardware.

### The Berlin Iron Bridge Co.

Berlin is but a small village and a railroad junction. East Berlin, where the Berlin Iron Bridge Co.'s works are located, is three miles distant on a branch railroad. It is only a small town, and the bridge company's works is its only important manufacturing establishment, with the exception of a foundry and shop belonging to Peck, Stow & Wilcox Co.,of New York, manufacturers of tinners' supplies and hardware specialties. The works of the bridge company are a splendid example of what can be done by New England enterprise in a location which would not generally be considered a favorable one, as it is far removed from the points of supply of its raw materials. The leading specialty of the works is not bridges, as the name of the company would indicate, but iron roofs and iron buildings for manufacturing purposes. The plant is one of the largest and best equipped of its kind in the country, and its products are shipped all over the United States, and to a considerable extent to foreign countries. It employs several hundred men, of whom about 40 are in the drafting department alone. The principal buildings are of the latest type of iron-frame construction, with corrugated iron roofs. The upper half of the siding is made entirely of glass windows, the lower half being left open, except in winter, when it is closed by removable wooden doors and battens. A very full illustrated description of these buildings will be found in Part III. of Merriman and Jacoby's "Text-Book on Roofs and Bridges." An interesting feature of the roofs is an asbestos sheet lining under the corrugated iron, held in place by an open wire netting. It prevents the condensation of moisture on the under surface of the roof and the consequent dripping, and at the same time its light color improves the lighting and the appearance of the interior. The company has recently erected a new forging shop 60 × 300 ft. It is equipped with two hydraulic and one steam upsetting machines, three steam hammers, numerous forges and a collection of machinery for making bolt heads and rivets and for tapping nuts. The largest building is the truss shop, 80 × 400 ft., which is equipped with machinery for cutting, trimming and punching the iron beams, channels, angles, etc., and with pneumatic riveting machines. The material is received from the stockyard at one end of the shop, and gradually progresses throughout the length as it passes through the several operations, and is delivered to the shipping yard at the other end. The method of laying out a roof truss is most interesting. The general drawings, blueprinted, are delivered to the pattern and template room, where the work is laid out full size on a floor like the molding loft of a shipyard. Wooden templates are then made the exact size for every piece, and holes are drilled in these templates showing the exact location of every rivet hole. The templates are taken to the truss shop, clamped to the pieces, and the locations of the rivet holes are marked on them by center punches driven through the holes in the templates. In this manner the work is executed with great rapidity, and the errors which might be made if the work was laid out from the drawings are entirely avoided. The works are now very busy, having received their full share of the orders caused by the recent revival of manufacturing industry.

## EXPRESS LOCOMOTIVE FOR THE CHICAGO, BURLINGTON & QUINCY R. R.

(With Inset.)

One of the notable departures from the ordinary types of express engines is that known as the "Columbia" type, which has four driving wheels (of which the rear pair are the main drivers), a two-wheel, or pony, leading truck, and a single pair of trailing wheels, which have ¼-in. extra play. This type of engine was first designed in 1891 by the Baldwin Locomotive Works to meet the special requirements of the Philadelphia & Reading R. R., as shown in our issue of Nov. 21, 1891. These engines had the Wootten type of firebox, and one of them, illustrated in our issue of June 15, 1893, was exhibited at the Columbian Exhibition. All of these engines were Vauclain four-cylinder compounds, and have given most excellent results in service. There was also exhibited at the Columbian Exhibition a locomotive of similar type, but with a narrower firebox, designed to burn bituminous coal, and this engine, which attracted much attention, was named the "Columbia," from which the name of this type of engine has been derived. This engine has, since the close of the exhibition, been run on several different roads, and has given very excellent results.

A similar engine to the "Columbia," but single expansion instead of compound, has recently been built for the Chicago, Burlington & Quincy R. R. by order of Mr. G. W. Rhodes, Superintendent of Motive Power. This engine is shown on our inset sheet this week, and we are indebted to the Baldwin Locomotive Works for drawings and specifications from which this article is prepared. The engine has a very handsome appearance, and among its striking features may be noted the arrangement of wheels on both engine and tender and the use of piston valves on a simple engine, while the size of the driving wheels—7 ft.—is unusual for Western roads. The general dimensions and particulars of the engine are as follows:

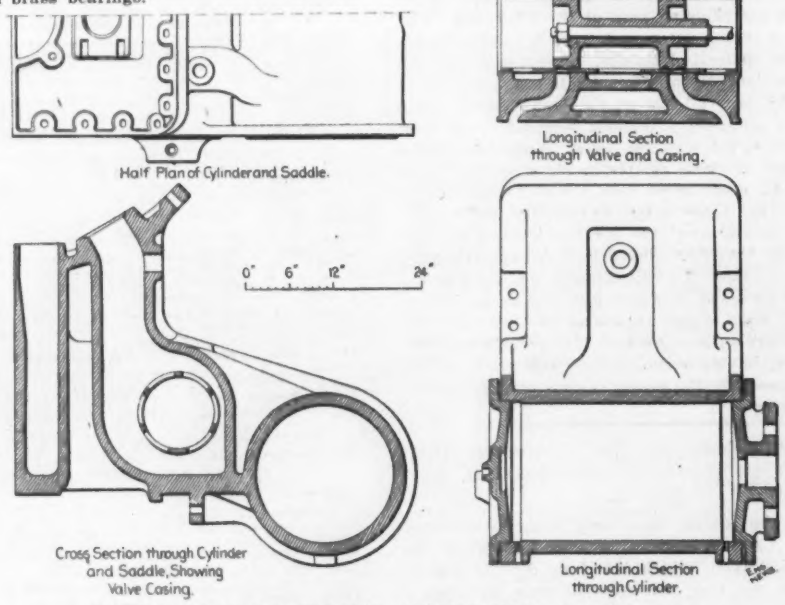
Double-End Express Locomotive; Chicago, Burlington & Quincy R. R.

| | |
|---|---|
| **Running Gear.—** | |
| Driving wheels, diameter | 7 ft. 0¼ in. |
| Truck " " | 4 " 2¾ ins. |
| Trailing " " (¼ in. ex. play) | 4 " 2¾ " |
| Tender " " | 3 " 6¾ " |
| Engine truck, length of radius bar | 6 " 7½ " |
| " " | Swing center |
| Journals, driving axles | 8½ × 12 ins. |
| " truck axle | 6½ × 10 " |
| " trailing axle | 7 × 12 " |
| " tender axles | 6¼ × 10 " |
| Pins, main | 6 × 6 " |
| " side rod, front | 5½ × 4 " |
| " " " back | 6½ × 4½ " |
| " crosshead | 3½ × 3 " |
| **Wheel Base.—** | |
| Driving | 7 ft. 6 ins. |
| Rigid (¼ in. ex. play to trail. wheels) | 14 " 6 " |
| Truck axle to front driving axle | 9 " 9 " |
| Trailing axle to rear driving axle | 7 " 0 " |
| Total engine | 24 " 3 " |
| " tender | 11 " 6 " |
| " engine and tender | 50 " 11¼ " |
| **Weight in Working Order.—** | |
| On front driving wheels | 39,600 lbs. |
| " main " " | 46,000 " |
| Total on " " | 86,200 " |
| On leading truck | 20,000 " |
| On trailing wheels | 31,800 " |
| Engine, total | 138,000 " |
| Tender " | 90,000 " |
| Engine and tender, loaded | 228,000 " |
| Tender, empty | 36,700 " |
| Of full coal capacity | 13,400 " |
| Of full water capacity of tank | 34,000 " |
| Allowed for water in boiler | 15,000 " |
| **Cylinders** | 19 × 26 ins. |
| Distance center to center | 7 ft. 1 in. |
| " " " " of valve stems | 3 ft. 9 ins. |
| " c. of cyl. to c. of piston valve | 1 " 8 " |
| Piston rod, diameter | 3¼ " |
| Form of crosshead and guides | Double bar |
| Connecting rod, length between centers | 8 ft. 4 ins. |
| Coupling " " " | 7 " 6 " |
| **Valve Gear.—** | |
| Type | Link motion |
| Valves, piston; diam | 10 ins. |
| " lap (inside), 1 in.; lead (full gear) | 1-32 in. |
| " maximum travel | 6 ins. |
| " clearance, each end | ¼ in. |
| Ports, steam | 21 × 1¾ ins. |
| " exhaust | 25½ × 6 " |
| Link, radius | 5 ft. 2 ins. |
| **Boiler.—Type** | Straight; radial stay |
| Diam. of barrel inside (smallest ring) | 4 ft. 9⅝ ins. |
| Thickness of barrel plates | 11-16 in. |
| " " firebox cover | ½ " |
| " " smokebox tube plate | ½ " |
| Height from rail to center line | 8 ft. 9⅝ ins. |
| Length of smokebox | 4 " 9 " |
| Steam pipe, area | 25.9 sq. " |
| Steam pressure, maximum | 200 lbs. |
| Dome: diam. outside, 2 ft. 8½ ins.; height | 2 ft. |
| **Firebox.—Type** | Radial stay |
| Length inside | 8 ft. 10¾ ins. |
| Width inside | 5 " 0 " |
| Depth at front | 4 " 9⅝ " |
| " " back | 5 " 2¾ " |
| Combustion chamber, length | 3 " 0 " |
| Thickness of side plates | ⅝ in. |
| " " back plate | ⅝ " |
| " " crown sheet | ½ " |
| " " tube sheet | ½ " |
| Grate area | 44.47 sq. ft. |
| Radial stays, diam | 1⅛ ins. |
| Staybolts, diam | 1 in. |
| Water space, width | 4 ins. |
| **Tubes.—Material, iron; number** | 210 |
| Thickness | No. 11 B. W. G. |
| Diam., outside | 2 ins. |
| Length between tube plates | 12 ft. 9 " |
| **Heating Surface.—Tubes, exterior** | 1,392.72 sq. ft. |
| Firebox | 151.61 " " |
| Combustion chamber | 36.79 " " |
| Total with exterior tube area | 5,180.12 " " |
| **Miscellaneous.—** | |
| Frames, center to center | 3 ft. 7 ins. |
| Exhaust nozzle, diam. at base | 12 " |
| " " " top, loose thimble | 4½, 4¾, 5 " |
| Smokestack, smallest diam | 14 " |
| " height from rail to top | 14 ft. 4½ " |
| Tender tank, steel; top, bottom and side, ¼ in.; outside | 3-16 ins. |
| Capacity of tank | 4,000 gallons |
| Capacity of coal space | 13,440 lbs. |
| Bumper beam, engine, length | 9 ft. 9 ins. |
| " " tender, " | 9 " 6 " |
| Brake fittings | Westinghouse-American |

The frames are of steel, and are dropped at the rear end to carry a deep firebox over the small trailing wheels. The boiler is made of 11-16-in. steel flange plates, having all the longitudinal seams butt jointed, with double covering strips calked inside and outside. The throat sheet is ⅛ in. thicker than shell plates, to prevent undue thinning where it is flanged. The waist is 58¾ ins. diameter at the smokebox end, with a straight top, and having a dome ring of pressed steel 1 in. thick. The firebox is of steel, and has a combustion chamber 3 ft. long, in which is a firebrick arch. The 1⅛-in. radial stays of the crown are screwed through the crown sheet and riveted over, and all solid staybolts and stays have drilled ends. The firebox is designed for burning soft coal, and has a grate of the rocking and drop pattern, while the ashpan has front damper slides in the bottom. The tubes are of iron, No. 11 B. W. G., with copper ferules on the swaged ends in the firebox tube sheet. The smokebox has an extension front, with wire netting, deflecting plate and spark hopper, and a straight smokestack is used. The feed is

supplied by two Sellers injectors. The cylinders are lagged with wood and cased with iron, and the cylinder-head covers are of hydraulic forged steel, polished and filled with asbestos. The boiler is lagged with asbestos cement, and jacketed with cold-rolled pickled steel (painted), with steel bands. The fittings include two Richardson sealed safety valves, the Leach sanding apparatus and the West bellringer. The Jerome metallic packing is used on piston rods and valve stems.

The cylinders have piston slide valves fitted in the saddles, as shown, an arrangement which is rather novel in simple engines, although it has been tried recently in England, and the design is very similar to that used in the Baldwin four-cylinder compound engines. It will be seen by the list of dimensions that these valves give a great port area. The pistons are of cast iron, with piston rods of open-hearth steel fitted to the cast steel crossheads, which have brass bearings. The cylinders and air pump are lubricated by Nathan automatic sight-feed lubricators placed in the cab. The connecting and side rods are of open-hearth steel, all of I-section, and the side rods have solid ends with heavy brass bushings put in by hydraulic pressure. The driving-boxes are of steeled cast iron, with brass bearings.


Half Plan of Cylinder and Saddle.
Longitudinal Section through Valve and Casing.
0" 6" 12" 24"
Cross Section through Cylinder and Saddle, Showing Valve Casing.
Longitudinal Section through Cylinder.

PISTON VALVE OF EXPRESS LOCOMOTIVE; C. B. & Q. R. R.

The wheels have cast steel centers, those of the driving wheels being 6 ft. 6 ins. diameter, and the tires are secured by shrinkage and retaining rings. The driving-wheel tires are of cast steel, 3½ ins. thick and 5½ ins. wide, both pairs being flanged. The Westinghouse-American outside equalized brake is fitted to the driving, trailing and tender wheels, and is operated in connection with the Westinghouse train brake, a 9½-in. brake-pump being used. The train air-signal is also fitted.

A special feature of this engine is the six-wheel tender, with plate frames, this having been adopted by the C., B. & Q. R. R. as an experiment to ascertain whether there is any advantage in European practice in this respect. The three-cylinder mogul engines of the Erie & Wyoming Valley R. R. (Eng. News, Feb. 7, 1895), as well as one or two of the Pennsylvania R. R. express engines, have six-wheel tenders. On the other hand, some of the English papers and engineers are advocating the use of the American tender on two four-wheel trucks for the heavy express engines hauling heavy trains long distances.

This tender has a tank of 4,000 gallons capacity, with ¼-in. plates for top, inside and bottom, and 3-16-in. plates for the outside, put together with 7-16-in. rivets. The tank is of U or horseshoe shape, with an inclined floor for the coal space, and rests upon a steel frame. The wheels have wrought iron centers and steel tires, and the axles have outside journals, the boxes working in pedestals. A railing extends beyond the tank to protect the footplate, and there is a cab over the tender deck.

## A MODEL ELECTRIC LIGHTING FRANCHISE FOR MONTCLAIR, N. J.

An electric lighting franchise which might well serve as a general model for towns and cities of moderate size, has recently been granted by the town council of Montclair, N. J., and is printed in full below.

Montclair is a suburb of New York, with a population of about 12,000. Its people have had several years of education in franchise matters through popular agitation over proposed franchises, beginning with an application for a street railway franchise four years ago, and continuing with unsuccessful renewals of similar applications and with repeated attempts to secure and carry out a franchise for electric lighting. A number of intelligent and public-spirited citizens of the town have so persistently urged that no franchises should be granted by the town without careful provisions for its present and future interests, that it has become generally recognized that to attempt to secure any other kind of franchise in Montclair is useless.

Three years ago a scheme for a local electric lighting company was agitated, but met with so little encouragement that it was soon dropped. Two years ago the leaders in the same movement renewed their application for a franchise, but in so different a spirit that a franchise was granted most favorable to the town in every particular; so favorable, in fact, that for the company to accept it was deemed financially impossible, unless the town would contract at the same time for electric street lighting. As the town authorities refused to do this, the company did not accept the franchise. This franchise provided for private lighting at ¾ cts. per 16-c. p. lamp-hour, equivalent to gas at $1.50 per M. ft., the company agreeing to furnish and renew all lamps and supply meters without cost to the consumer. A fair maximum rate was fixed for public lighting, and the town reserved the option of buying the plant at an appraised value, with no allowance for either the franchise or the earning power of the plant. In addition, quite detailed specifications for the plant were incorporated in the franchise, and all plans were to be subject to the approval of the town council or its engineer.

It will be seen even from the above meager outline, and from the franchise of 1895, printed below, that the latter, while aiming to guard the interests of the town at every point, is more favorable to the company than that granted two years ago. The fact that the company proposes to build a plant and work up a business among private consumers only, makes this necessary. The franchise is discussed briefly in our editorial columns.

The credit for the 1895 franchise is largely due to Messrs. Charles F. Coffin and Starr J. Murphy, chairmen, respectively, of the lighting and law committees of the town council, and to Mr. W. W. Ames, of the New York Electric Equipment Co., who represented the Montclair Light & Power Co., and who resides in Montclair. The generating plant will be located at the pumping station of the Montclair Water Co., of which Mr. Jas. Owen, M. Am. Soc. C. E., is Engineer and Superintendent. Regarding the provision that no poles can be placed without the written consent of the property-owners on the street, we are informed that this is in accordance with the state laws.

The ordinance granting the franchise is as follows:

Sec. 1. Subject to the conditions hereinafter set forth, the Montclair Light & Power Co. shall have the right to use any of the streets and highways within said town, through and upon which to place poles or wires for an electric lighting system in the town of Montclair, for the period of 15 years, from and after the passing of this ordinance.

Sec. 2. That the use of the streets and highways shall be subject to the following regulations and restrictions.

1. No pole shall be erected in any street or highway of said town without the consent in writing of the owner or owners of the property on or in front of which said pole or post is to be erected.

2. Poles must be set inside the curb line of the street, and as near to the curb line as may be, without damage to the curb. The poles so erected by said company shall not be used or allowed to be used for any other purpose than the carrying thereon of wires for electric light or fire alarm purposes, without the special consent of the council of the town.

3. No bill posting, writing or advertising signs of any kind shall be permitted on said poles.

4. All wires used by the company must be so placed and located as in no way to interfere with the safety or convenience of persons travelling on or over said streets and highways.

5. Poles must be placed not less than 125 ft. from each other, and all decayed or unsafe poles must be removed and replaced within five days after notice given in writing by the town council, or its duly authorized representatives, to any officer of the company, or any of its agents in charge of the plant, wherever found.

6. No tree shall be cut down, and no branches shall be cut or removed by the company without permission in writing first obtained from the owner of the soil on which such tree may stand, indorsed by the town engineer.

7. For each and every violation of any of the foregoing provisions of this ordinance by the said company, or any of its officers, agents or employees, the said company, and each and every of its officers, agents and employees, or other persons participating therein, shall be subject to a fine of $20, to be recovered in the manner provided by law for recoveries for the violation of the ordinances of the town.

8. All poles owned and set by the company shall be of cedar, cypress, or yellow pine, of the usual hexagonal form, with pointed end, painted a neutral gray or green tint, with a suitable good paint. All poles shall be not less than 28 ft. in length, of 6 to 8 ins. diameter at the top, and 8 to 12 at the butt, the size to be governed by the location of the pole and the number of wires supported by it. All poles must be set at least 6 ft. in the ground, and must not be guyed. The usual cross-arms, insulators, etc., to be first class in every respect, and in accordance with the best usage in cities. The poles must be straight, and of good appearance. All wires must be properly insulated, and run so as to touch insulators only. Converters, when any are needed, must be supported on poles or on brick or stone-work of buildings, and must not be placed on wooden buildings of any sort.

All materials and machinery used in constructing and furnishing the plant shall be of standard quality, and equal to that used and approved by the best engineers in constructing modern electric light plants.

9. Upon the completion and installation of the plant, or any extensions thereof, the town council may, at its option, employ an electrical engineer to inspect and determine whether the same has been constructed in accordance with the provisions of this ordinance, and if he shall report that it is not in accordance with the ordinance, the company shall make such changes as may be necessary to comply with the same.

Sec. 3. The company shall supply all demands for lighting, during the life of the franchise hereby granted, as follows:

1. For private lighting up to 1,000 incandescent lamps, within 120 days from the passage of this ordinance, and

must increase its capacity to 1,000 more whenever and as soon as 500 additional lamps are demanded, and must continue to increase by units of 1,000 lamps whenever there is a demand for 500 lamps in excess of its existing capacity.

2. Lamps to be 50 or 104 volt, 16 c. p., and price not to exceed 20 cts. per 1,000 watts, less 5% discount if bill is paid within 10 days from receipt of same by the consumer.

3. The company shall make connections between house wiring and street wires, and shall furnish, install and maintain meters without charge and without rental, and shall make regulations for interior wiring and installation of fixtures, motors, converters, meters and all other appurtenances.

4. The company must be prepared to enter into contract with the town at any time upon terms to be agreed upon by the council and the authorized agents or officers of the company to furnish and operate not less than 14 lamps of 1,200 c. p. for street lighting, to burn from dusk to dawn; but the rental to be paid by the town for such arc lights shall not exceed the rate of $100 per annum per lamp.

5. The company must also be prepared to enter into contract with the town at any time, upon terms to be agreed upon between the council and the authorized agents or officers of the company, to furnish and operate not less than 50 incandescent lamps of 32 c. p. each for street lighting; but the rental to be paid by the town for such incandescent lights, to burn from dusk to dawn, shall not exceed the rate of $25 per annum per lamp.

6. Said company shall extend the public lighting system whenever and wherever ordered by the town council on any of the streets of the town, such extensions to be under the same conditions and provisions and rates as may be in force at the time the orders for such extensions are made.

7. The company shall furnish complete, without charge, all parts, poles or other supports for lamps ordered or contracted for by the town for public lighting, and shall also furnish and renew, without charge, all lamps for both public and private lighting, except such private lamps as may be broken through carelessness of consumers, and shall make such renewals as often as may be necessary to give the candle power herein specified.

8. All lamps, public or private, furnished by said company during the life of its franchise hereby granted, shall give an efficiency of not less than 87½% of their rated candle power, and said lamps and the current and voltage supplied to the same may at any time be tested by the town to determine whether the said efficiency is being maintained.

Sec. 4. All house-wiring and connections therewith must be in accordance with the rules and regulations of the New York Board of Fire Underwriters, and must be approved by the chief of the fire department of the town of Montclair.

Sec. 5. The company may establish rates and make such rules and regulations as may be necessary, subject always to the terms of this ordinance.

Sec. 6. The company may use such of the fire alarm poles as are under the control of the town, and in lieu of rental shall keep all the fire alarm wires in first-class working condition, and furnish current for the operation of the town's fire alarm system, and shall allow the town, at its own expense, to string its fire alarm wires on any of the poles of the company, and the company must, if the council so direct, immediately upon the installation of the plant, or at any time thereafter, during the life of this franchise, place a 1,200-c. p. arc light at the junction of Church St., Fullerton and Bloomfield Aves., at a point to be indicated by the town council, and place a similar light at or near the intersection of Spring St. with Bloomfield Ave., and maintain these two lights free of all and any expense to the town of Montclair for a period of three years, the said arc lights to be lit each and every night in the year, and kept burning from dusk to dawn.

Sec. 7. The town of Montclair shall have the option of purchasing the plant from the company at the expiration of the fifth year, or the tenth year, or the fifteenth year, from the passing of this ordinance; the price to be paid by the town to be determined by three disinterested appraisers, one to be appointed by the town council of Montclair, one by the company, and these two to select a third, provided that written notice of the intention to purchase the plant be given the company at least six months in advance; and provided, further, that in determining the price to be paid by the town in case of such purchase nothing shall be allowed for the value of the franchise; and if such electric lighting system shall at any time be operated by a boiler or power plant which is also used for other purposes, the plant purchased by the town shall not include such portion thereof as is used for such double purpose, and the price shall be fixed with that in view, unless both the council and the company shall elect to include the same.

Sec. 8. The terms and provisions of this franchise shall be construed to be conditions, and the failure of the company to comply with the same or any of them after 30 days' demand in writing made by the council, shall operate as a breach of condition, and shall give the council the power and authority to cancel this ordinance and to annul all the rights and privileges of the said company thereunder.

Sec. 9. On the expiration of the period of fifteen (15) years from the date of the passage of this ordinance, all rights and privileges of the company thereunder, and all rights to use and occupy the streets and highways with its poles and wires shall wholly cease and determine.

Sec. 10. That this ordinance shall not be binding on the town of Montclair, unless the Montclair Light & Power Co. shall file its acceptance in writing with the town clerk within 30 days after the passage thereof.

Adopted Nov. 18, 1895.

John H. Wilson, Councilman-at-Large.

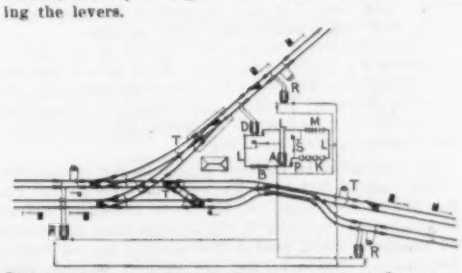
Attest: H. Trippett, Town Clerk.

## A SIMPLE ELECTRIC-LOCKING CIRCUIT FOR INTERLOCKED CROSSINGS.*

By N. H. Elliott.**

By locking electrically the levers of an interlocking machine, and thus taking the control of the signals from the operator after they have once been cleared for an approaching train, the use of the crossing is undoubtedly made safer. There are several ways in which this electric locking of the levers may be accomplished, and the method adopted will usually depend upon the conditions at any particular crossing. The Union Switch & Signal Co. was probably the first firm to advocate electric locking in this country. Its system accomplished all that was desired of any arrangement of circuits, and the only claim made for the circuits described here is that they are more simple. It may be stated that the circuits described are in actual operation on the Chicago, Milwaukee & St. Paul Ry.

In the interlocking shown in the illustration, five different circuits are made use of, a track-locking circuit, T; a locking circuit, L, used to energize the electromagnet of the locks and keep them unlocked, and three releasing circuits, which are marked R, and are used to restore the locking circuit after it has once been broken, thereby lifting the lock armatures and releasing the levers.




Electric Locking Circuit for Interlocked Crossing; Chicago, Milwaukee & St. Paul Railway.

A, Locking Magnet; B, Signal Circuit Breakers; D, Track-Locking Circuit Relay; K, Electric Locks; L, Locking Circuit; M, Main Battery; P, Relay Contact Points; R, Releasing Circuit and Relay; S, Hand-Releasing Switch; T, Track-Locking Circuit.

The locking circuit, L, which, for the sake of distinction, is shown in heavy lines, is made to pass through the locking magnet, A, through the contact points, P, of the relay armature, through the contact points of the armature of the relay, D, through the locks, K, through the circuit breakers, B, and the releasing switch, S, M being the battery of about twelve cells used to energize the magnet A and the locks, K, whenever the circuit is complete.

The locks being released, and the armature of the relay, A, held up when the circuit is completed, any break in the circuit as will occur at the points B and D, will, of course, drop the locks and also the armature of the relay, A, the armature breaking the lock circuit at the point P, and preventing the locking circuit from being restored, even if the circuit was again made good at the point where it had previously been broken. To restore the circuit, the relay, A, must be again energized, when the armature will be lifted and a contact made once more at the point P. To energize the magnets, a shunt circuit through the points of the releasing relay, R, is used. This bridges the gap made by the points P, and completes the locking circuit from the battery to the relay R, the magnet A, the circuit breakers, B, and the switch, S, the armature of the relay A being raised and the circuit completed once more through the points P and the locks.

But as the resistance of the locks is greatly in excess of what it is through the shunt circuit, not enough current will pass through the locks to energize them so long as the shunt circuit is completed, and they are, therefore, lifted only after the shunt circuit has been broken. From this it will be seen that by passing the locking circuit through the contact points, P, of the relay, A, and around the locks, the control of the circuit is taken out of the hands of the operator, for while he may break the circuit and lock up the machine at will, he is powerless to restore the locks, and must wait for the train to pass out of the interlocking limits to release the levers.

The releasing circuits, of which there are three, one for each track, on which trains usually pass out of the interlocking, are only 60 ft. in length, the relay being energized and the armature held up so long as there is no pair of wheels on the track to form a short circuit. When the relay is short-circuited, the armature falls and makes a back contact, completing the shunt circuit through the locking magnet, A, around the locks, and restoring the locking circuit in the manner spoken of. As the circuit is made complete without passing through the locks, they are not released until the locking circuit through the releasing relay has been broken, so that as long as there is a train on the releasing circuit, and the relay is demagnetized, the machine is still locked up. This insures that not only must a train have reached the releasing circuit, but it must pass out of it before the levers will be released.

This track-locking circuit energizing the relay D, the armature of which when down is made to break the locking circuit and prevent the locks from being released, is used to prevent a train passing over a releasing section on one track from releasing the locks before a train which may be on one of the other tracks has passed out of the interlocking. In this way an operator is prevented from making a mistake and changing the switches in front of any engine that may be working within the limits of the interlocking, and which, for the moment, he may have overlooked. The circuit breakers, B, one of which is provided for the lever of each home signal, are used to break the circuit and lock up the machines whenever a home signal is cleared, thus insuring that, while the signal may be returned to danger at any time, no change can be made in the switches of the route that had been set.

As the locking circuit is the one that is broken when the home signal is cleared, the circuit will, of course, not be restored and the locks released when a train passes out of the interlocking, if the signal has not been returned to danger before the last car has passed off the releasing circuit. This means that an operator must attend strictly to his duties, or else he may be caught with the machine locked up when there is a train wanting to use one of the other tracks of the crossing. In case of a failure of the circuits to release, a releasing switch is provided which may be closed and the levers unlocked. This switch is enclosed in a locked box having a piece of glass set in the cover, which the operator has to break before he can get at the switch to close it. In this way a check is had upon his attention to his duties, as every glass broken has to be accounted for and a good reason given for the same, a failure of the apparatus being the only excuse accepted. A second switch enclosed in another box, which is of the same construction as the first, is provided, which, when closed, will do away with the track-locking circuit without throwing the locking entirely out of service. As it is a somewhat difficult matter to maintain a track circuit where there are many pipe and wire lines crossing under the rails, the use of this switch will be found to give almost the same protection as with the track-locking circuit in use, while admitting of the use of circuits that will seldom or never fail. If at any time changes in the rails or repairs to the interlocking are being made, this switch can be closed by the repair man and the locking feature for the greater part be maintained.

The order in which the several operations take place when a train is admitted to and passes out of the interlocking are as follows: When the home signal is cleared the locking circuit is broken by the circuit breaker, B, and the locks and the armature, P, of the relay A dropped, the armature of the relay D being also dropped as soon as the train reaches the track-locking circuit. When the train reaches the releasing circuit, R, the armature of the releasing magnet, R, drops, making a back contact, and completes the locking circuit around the point P as soon as the circuit is restored at the other points where it has been broken.

If the operator has restored the home signal to danger, as soon as the train passes off the track-locking circuit, the relay D is energized, allowing the circuit to be completed by the releasing relay when the train has passed on to the releasing station. Completing the circuit, L, energizes the magnet, A, attracting its armature and completing the circuit at the point P, but without lifting the locks. On the train passing off the releasing

* Condensed from a paper read before the Railway Signaling Club, Nov. 12, 1895.

** Signal Engineer Chicago, Milwaukee & St. Paul Ry.

section, the relay R is energized, breaking the shunt circuit and forcing the current to pass through the locks, releasing them, the levers being left once more under the control of the operator. Where it is desired to lock the levers of a plain crossing interlocking, a much simpler arrangement can be used than the one described.

## TESTS OF FIREPROOF FLOORING MATERIAL.*

By George Hill, Assoc. M. Am. Soc. C. E.

The tests described in the paper were made by means of apparatus constructed specially for the purpose. A 15-in. I-beam, 7 ft. 9 ins. long, and weighing 80 lbs. per ft., was attached to the skewback beams, between which the arches were built, by two wrought iron ties. A hydraulic ram was attached to the lower side of this beam, and by forcing down its plunger, pressure was applied to the arch under test. The plunger had a stroke of 7 ins. and a cross-section of exactly 50 sq. ins. The ram could be moved along the beam to which it was attached, and was connected by a copper pipe with the force pump by which the pressure was obtained. A set of three pressure-recording gages could be connected to the chamber of the ram; one gage had a range of 3,000 lbs. per sq. in., the second a range of 1,500 lbs., and the third a range of 400 lbs. The amount and the rate of application of the load were recorded automatically by these instruments, and it was only necessary to multiply the readings by 50, the area of the plunger, to obtain the total pressure exerted on the arch.

Twelve tests were made to determine the strength of the Melan system of concrete-iron arches; 15 of tile arches with mortar joints, and 12 of tile arches without mortar, a little damp sand being used to bed the skewbacks of the side construction arches, and to even up the top for the planks used in applying the load.

The Melan arches had a span of 6 ft., and the ribs were either 3-in. T or 4-in. I-sections, weighing 6.6 and 7 lbs. per ft., respectively. The rise at the crown was 6.97 ins. with the I-sections., and 8.53 ins. with the T-sections. Considering the manner in which they were built, the author considers them of the same character as would be found in a building where a reasonable supervision was exercised. The first cracking, or splitting, in these arches occurred under loads of 27,000 to 35,000 lbs., and failure occurred under loads of 35,000 to 58,000 lbs.

The tests of the tile arches showed that the side-construction type requires a skew block in which the inclined member on the line of the arch thrust runs back to a solid support against either the fillet or the flange of the skewback beam. The end construction arch requires good mortar and reasonably good bedding to make the joints which transmit the pressure adequate to their duty, the weak point being the mortar in the end joints. When well bedded, the end construction arch is very much the stronger.

## ANNUAL MEETING OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

The sixteenth annual meeting of the society is being held this week at the society's house in New York city. It promises to be one of the largest meetings ever held by the society, 247 members having been registered as in attendance by Wednesday noon. The first session was held on Tuesday evening, and was called to order by ex-President Holloway, who made a brief statement concerning the lamented death of President Davis, and announced that Mr. Charles E. Billings, of Hartford, Conn., had been elected by the council as president for the unexpired term. President Billings having taken the chair, Secretary Hutton read the minute prepared by the council in relation to the death of Mr. Davis, which was adopted by the society. The President then read an address, in which he gave an account of the beginning of the interchangeable system of making firearms, sewing machines, watches, etc. In 1854 and 1855 there was made in Vermont the machinery for the manufacture of the English Enfield rifle, and to America is due the entire development of the interchangeable system, including the making of drop forgings, as well as the machine finishing of the parts. The drop hammer was first used by Samuel Colt in 1853, in the manufacture of the Colt revolver. Mr. Billings then described the modern drop-forging hammer, which he illustrated by drawings.

Considerable discussion followed the reading of the paper, especially in regard to the method of making foundations for drop presses, hammers, etc. In former times it was always considered necessary to put elastic timber foundations under the anvils, but at the Calumet & Hecla mines it was found that a great increase in output was effected by dispensing with the spring timbers, and founding the base, or anvil, on solid rock. Mr. John Fritz described the foundations of the great 125-ton hammer at Bethlehem, Pa. He said that the bottom of the foundation was made by driving piles over an area of 60 ft. square, as close as they could be driven, then over them was placed layers of 24-in. timbers, and on them the 1,500-ton block. In operation the block settled unequally. It was taken out and 2 ft. of shavings placed below the timbers, and 1 ft. of cork above them, and the foundation has given no trouble since. The elastic material under the block was not used to improve the efficiency of the hammer, but to save the foundations, which was on soft ground. If there had been a solid rock foundation there would have been no trouble.

The meeting then took up the discussion of practical topical questions which had been proposed by members in advance of the meeting. The two questions considered were the following:

For filtering oil having very finely divided metallic particles in suspension, what have you found to be the best filtering material, either for one operation or in a series?

What information can you give as to the best method for the extraction of oil from condensed steam, where it is desirable to use the exhaust steam repeatedly for boiler feed purposes?

No answer was given to the first, but there were a great many answers to the second. Several members held that the best way was to avoid using any oil in the engines, or at most to use only the smallest possible quantity. Several instances were presented of engines running satisfactorily without oil for several years. "Oil extractors" were condemned by some speakers as being very inefficient. Large filtering tanks filled with such material as hay, crushed coke, sawdust, excelsior, sponge, sand, etc., were generally favored. A series of three large settling tanks in a row, the discharge taking place from 6 ins. below the top of one to the bottom of the next in order was recommended, the bulk of the oil being skimmed off the first in order and smaller quantities off the second and third. A sponge filter for separating oil from water condensed from a 2,000-HP. marine engine was described. It was a rectangular tank 12 ft. long, 2 ft. wide, 18 ins. high, filled with sponge tightly packed in. The water was forced through it lengthwise, under pressure. Two such tanks were used, one in service and the other in reserve, tanks being changed and thoroughly cleaned every day.

The second session was held on Wednesday morning. The first business was the reading of the reports of the Council, of the Treasurer and of the Library Association. The society is in a flourishing condition financially, and now numbers over 1,700 members.

The tellers then presented their report of the election of officers for the ensuing year. They are as follows: For President, John Fritz; for Vice-Presidents, Geo. W. Melville, Chas. H. Manning and Francis W. Dean; for Managers, N. C. Stiles, E. D. Meier, Geo. W. Dickey; for Treasurer, Wm. H. Wiley.

The Committee on Uniform Standards for Testing Materials had no report of its work to present, but the reporter of the committee, Mr. G. C. Henning, read an account of the meeting of the International Conference on Standard Tests, held a few months ago at Zurich, Switzerland, which he had attended as delegate from the society. The Conference was attended by over 300 delegates, and the record of its proceedings covers over 1,200 printed pages, which unfortunately are not yet translated into English. Among the subjects considered by the conference were tests of oils, paper, textile fabrics, metals, wood, stone, mortars, cements, effect of acids on wires, micro-photography of metals, weldability, abnormal fractures, etc. The Committee on Standard Code for Boiler Tests reported progress.

Mr. H. De B. Parsons, member of the joint committee of the society, the Fire Underwritrs and the Architectural League for experimenting upon the resistance to fire of various systems of building construction, especially of the skeleton type of buildings, made a statement of the nature of the tests proposed to be undertaken. Rooms or furnaces are to be built which can be heated to any desired temperature by gas. One room will represent styles of walls, columns, etc., and another different styles of floor construction. An advisory board of 20, consisting of men from various sections of the country, prominently identified with building interests, has been appointed to co-operate with the committee. The tests will be made at the Continental Iron Works in Brooklyn, N. Y. Mr. Julio F. Sorzano, member of the society, through the Secretary presented a blank form of petition to Congress, for which he asked signatures, praying for the early organization of the American commission to the Paris Exhibition of 1900.

Papers were then presented by Mr. Samuel McElroy on "Water Power of Caratunk Falls, Kennebec River," and by Samuel Webber on "Water Power, its Generation and Transmission." A brief discussion followed the reading of the papers, after which "topical questions" were discussed as follows:

What is the economy, if any, of damper regulation in firing with liquid or gaseous fuel?

In boilers fired with liquid or gaseous fuel, is there any advantage in simultaneous regulation of the fuel supply and the position of the damper, either by the same or by different mechanisms under the ordinary control of the steam pressure?

Are there any conditions under which oil fuel is cheaper than coal for generating steam at points in the Atlantic seaboard states; if so, what are they, and where?

The reply to each of these three questions was "No," but each called forth some discussion, with illustrations of experience with fuel oil.

The remainder of the proceedings will be given in our next issue.

The Buffalo-Niagara Falls Power Co. controversy over a franchise for supplying that city with electric power has apparently been settled, the city council of Buffalo having at last produced a grant satisfactory to the Niagara Falls Power Co. The most important change from previous proposed grants is the substitution of 2½% for 5% as the tax upon the company for all power sold within the city, and this is not to be imposed until after six years. The company is to be prepared to supply 10,000 HP. to city consumers by June 1, 1897. The grant will be for 36 years from date of acceptance, and at the end of 18 years the various conditions imposed by the franchise are to be subject to revision by a board of arbitration, consisting of a representative of the company, the Mayor of Buffalo, and a third person, to be chosen by these two. The grant provides against all possible damage to the property of Buffalo and its citizens, including corrosion of pipes by electrolysis. An important provision is that no change in price for power shall be made after once being fixed.

The ability of an ordinary fire engine to force water to the top of modern 16-story and 20-story office buildings was successfully proved at the Masonic Temple, Chicago, Ill., on Nov. 28. This building is 316 ft. high from the curb to the top of the roof. The test was as follows: A 3-in. standpipe was connected with the engine, 150 ft. away, by two lines of 2½-in. hose, and to the top of the standpipe was attached 50 ft. of 2½-in. hose, with a 1¼-in. nozzle at the end. The total distance from the engine to the nozzle was 523 ft., made up of 150 ft. of hose at the base, 323 ft. of standpipe and 50 ft. of single hose. A water-gage was attached to the base of the standpipe and another to the nozzle on the roof, and pressure readings were taken at the nozzle with different pressures at the engine. The following were the results obtained:

| Pressure at engine, | Lbs. | | gave pressure at nozzle of | Lbs. |
|---|---|---|---|---|
| " " " | 100, | " | " " " " | 0 |
| " " " | 150, | " | " " " " | 5 |
| " " " | 175, | " | " " " " | 12 |
| " " " | 200, | " | " " " " | 18 |
| " " " | 225, | " | " " " " | 20½ |
| " " " | 240, | " | " " " " | 24 |

The engine was built by the American Fire Engine Co., Cincinnati, O., on Ahren's patent, and weighed 8,500 lbs. It had double cylinders and plungers, 7½ × 8 ins., and 4¾ × 8 ins., respectively. The diameter of the boiler was 36 ins., and it had 212.03 ft. of heating surface. The area of grate surface was 6.23 ft. A report to us from Mr. D. J. Swenie, Fire Marshal, Chicago, states that the standpipe was pit at the base, and showed a bad leak, otherwise the results would have been better. As it was, the tests demonstrated conclusively that with 200 lbs. pressure at the engine a good fire stream can be secured at the top of the tallest buildings yet erected. In view of the recent newspaper talk about the inefficiency of present apparatus for fighting fires in tall buildings, this test is of much interest.

Three companies have entered mechanical filters in the water-purification tests at Louisville, Ky. The O. H. Jewell Co., of Chicago, put a filter in operation in July, the Cumberland Manufacturing Co., of Boston, Mass., started its Warren filter in September, and the Western Filter Co., of St. Louis, Mo., is now erecting two filters, a gravity and a pressure. The other two companies have gravity filters in use, each of 250,000 gallons capacity, and it is said that each of the Western filters is of the same size. As stated some weeks ago, Mr. Geo. W. Fuller is employed by the Louisville Water Co. as Chief Chemist and Bacteriologist during these tests. He is assisted by Mr. Robert Spurr Weston. We are informed that the companies have competent men in charge of the plants, so that the chemical and bacteriological purification effected may be expected to be the best the filters are capable of.

A contract for a 20,000,000-gallon artesian well supply for Camden, N. J., has been awarded by the city council to the Wagner Water Supply Co., of Dayton, O., for $548,818, conditioned on satisfactory results being obtained from test wells, half the cost of which will be borne by the city. The water must be delivered to the city mains. The company guarantees the supply for only five years. A veto by the mayor has been predicted; otherwise it is said the matter will be taken into the courts. The award was made on one of 11 bids received on Oct. 17, and given, in part, in our Construction News Supplement for Oct. 24.

*Abstract of a paper read before the American Society of Civil Engineers at the meeting on Dec. 4. Accounts of some of the tests have been given in ocr columns.

## CONTENTS OF SUPPLEMENT.

PERSONALS..... 181
ENGINEERING SOCIETIES..... 181
Coming Technical Meetings..... 181
CONSTRUCTION NEWS:
List of Contracts Pending..... 182
Railways..... 182
Street and Electric Railways..... 183
Electric Light and Power..... 183
Bridges..... 184
Buildings..... 184
Water-Works..... 185
Irrigation..... 185
Sewerage..... 185
Garbage Disposal..... 185
Streets and Roads..... 186
Manufacturing Plants..... 186
Miscellaneous Contracts and Supplies..... 186
Contract Prices..... 187
Metal Market Prices..... 187
INDUSTRIAL NOTES..... 187

## PERSONALS.

(Readers are requested to contribute items of interest for publication in this column.)

Mr. W. W. Lyle, of the firm of Lyle & Morton, sewer contractors, of Erie, Pa., died at Meadville, Pa., on Nov. 22.

Mr. A. J. Phillips has been elected a member of the Board of Water Commissioners of Kingston, N. Y., to succeed Mr. J. W. Searing, resigned.

Mr. C. F. Huggins has been appointed General Superintendent of the Choctaw, Oklahoma & Gulf Ry., with headquarters at South McAlester, Ind. T.

Mr. James T. Gorman, General Superintendent of the Philadelphia Traction Co., has resigned, after a service of 36 years with Philadelphia's surface railways.

Mr. Albert T. Methols died at Pittsburg on Nov. 28. He was long connected with the Pittsburg Bridge Co., and was Superintendent of the works for the past 12 years.

Mr. J. Kruttschnitt has resigned from the office of Manager and Director of the Texas & New Orleans Division of the Southern Pacific Ry., and Mr. W. G. Van Vleck has been elected his successor.

Mr. A. Sorge, Jr., M. Am. Soc. M. E., has been engaged by the Illinois Steel Co. to examine and report on its plant at Joliet, Ill., with a view to increasing the plant's efficiency and effecting economies in various departments.

Mr. R. R. Leitch, Chief Engineer of the U. S. cruiser "Boston," has become so broken down in health from overwork that he has been pronounced unfit for service by a medical board, and another Engineer has been assigned to the vessel.

Mr. Mahlon S. Brink, a blast furnace builder, died at Duluth, Minn., on Nov. 23, aged 73 years. Mr. Brink is said to have constructed the first anthracite blast furnace in the United States, at Catasauqua, Lehigh county, Pa.

Mr. Isham Randolph, Chief Engineer of the Chicago Drainage Canal, recently delivered a lecture upon that work before the students of the University of Illinois. The address was illusterted by stereoptican views from photographs along the canal.

Mr. G. F. Evans, formerly Superintendent of the Southern Division of the Boston & Maine has been made Assistant General Manager of the entire line, with headquarters at Boston, Mass. Mr. Evans was General Manager of the Louisville, Evansville & St. Louis before going to the Boston & Maine in 1892.

Mr. William Brookfield retired from the office of Commissioner of Public Works of New York city on Dec. 2, after serving nine months. Mr. Brookfield gave no reason for his action other than he had grown tired of the cares of his office. Mayor Strong has appointed Gen. C. H. T. Collis, formerly Deputy Commissioner, as Mr. Brookfield's successor.

Mr. Charles Wood, Chief Engineer of the Cincinnati, Hamilton & Dayton Ry., died on Nov. 28 at Wyoming, O., at the age of 35. Mr. Wood came to the United States about 15 years ago, and took a four years' course at the Massachusetts Institute of Technology. He entered the employ of the Cincinnati, Hamilton & Dayton eight years ago, as Assistant Engineer, and upon the resignation of Chief Engineer James Ramsey, succeeded to the position which he held at the time of his death. Mr. Wood was a capable engineer in every way. His last work of importance was the planning and superintending the construction of the elevator at Toledo, with a capacity of 1,000,000 bushels, which his company has erected.

Prof. A. W. Smith, of the Case School of Applied Science at Cleveland, O., met with a serious accident on Dec. 2 while inspecting, with a class of students, a blast-furnace plant in that city. While passing under an ore-car elevator, of whose presence or character he did not appear to be aware, it descended upon his head and shoulders, completely doubling up his body. Several of the students had a narrow escape. The car was raised as quickly as possible, and it was found that life was not yet extinct. The injuries are most serious, but there is still a possibility of recovery. Professor Smith is a chemist of much ability, having graduated from the University of Michigan, and the Case School of Applied Science, with a post-graduate year in Switzerland.

Mr. Arthur P. Davis, Hydrographer of the Geological Survey, has been detailed at the request of the Indian Bureau, to investigate the water supply and to plan a system of irrigation for the Gila River Indian Reservation in southern Arizona. The Pimas and Maricopas, who occupy this reserve, have, from prehistoric times, used the waters of the Gila River for irrigation. Of recent years the white settlers have been gradually encroaching upon their ancient rights, by diverting the waters above the reservation, until the Indians, from lack of water for agriculture, are reduced to a dependent condition. For several years the Government has issued them rations, and must either continue that practice or provide a water supply by storage or otherwise.

Mr. Horace L. Eaton, late City Engineer of Somerville, Mass., whose death by suicide while temporarily deranged was noted in our last issue, has had an official tribute paid to his memory by Mayor Hodgkins, of Somerville, at a late meeting of the board of aldermen. Mayor Hodgkins spoke of Mr. Eaton's long and faithful service to the city, his thorough knowledge of his profession and careful training. He described him as possessing a firm will coupled with a very sensitive and highly-nervous disposition. The unusually severe duties lately falling upon him had overtaxed his strength and undermined his nervous force to such an extent, that when subjected to the late extremely sensational investigation of his department, which threatened his hitherto spotless reputation, his nervous system succumbed. Mayor Hodgkins concluded by saying that his sorrowing friends will continue to regard him as "an honest, conscientious, high-minded and faithful official," and "an upright, beloved and honest man."

## ENGINEERING SOCIETIES.

### COMING TECHNICAL MEETINGS.

TECHNICAL SOCIETY OF THE PACIFIC COAST.
Dec. 6. Secy., O. H. Von Geldern, 819 Market St., San Francisco.

ENGINEERS' CLUB OF PHILADELPHIA.
Dec. 7. Secy., L. F. Rondinella, 1122 Girard St.

ENGINEERS' CLUB OF KANSAS CITY.
Dec. 9. Secy., F. W. Tuttle, Baird Building.

CIVIL ENGINEERS' CLUB OF CLEVELAND.
Dec. 10. Secy., F. A. Colburn, Case Library Building.

DENVER SOCIETY OF CIVIL ENGINEERS.
Dec. 10. Secy., H. Breen, 36 Jacobson Block.

NORTHWEST RAILWAY CLUB.
Dec. 10. Secy., G. A. Seley, 80 Metropolitan Block, St. Paul, Minn.

NORTHWESTERN SOCIETY OF ENGINEERS.
Dec. 10. D. W. McMorris, Burke Bldg., Seattle, Wash.

WISCONSIN POLYTECHNIC SOCIETY.
Dec. 10. Secy., W. K. Means, Loan & Trust Bldg., Milwaukee.

NEW ENGLAND RAILROAD CLUB.
Dec. 11. Secy., F. M. Curtis, P. O. Box 1576, Boston, Mass.

NEW ENGLAND WATER-WORKS ASSOCIATION.
Dec. 11. Quarterly meeting at Boston, Mass. "Operation of a Pumping Plant by Electricity," by Chas. A. Hague. Secy., J. C. Whitney, Newton, Mass.

ENGINEERING ASSOCIATION OF THE SOUTH.
Dec. 12. Secy., Lucius P. Brown, Nashville, Tenn.

ENGINEERS AND ARCHITECTS' CLUB OF LOUISVILLE.
Dec. 12. Secy., Jas. K. Zollinger, Norton Building.

NORTHWESTERN TRACK AND BRIDGE ASSOCIATION.
Dec. 13. Secy., D. W. Meeker, St. Paul, Minn.

INDIANAPOLIS ENGINEERING CLUB.
Dec. 14. Secy., C. C. Brown.

MONTANA SOCIETY OF CIVIL ENGINEERS.
Dec. 14. Secy., Forrest J. Smith, Denver Block, Helena.

ENGINEERS' CLUB OF MINNEAPOLIS.
Dec. 16. Secy., E. Nexson, Kasota Block.

WESTERN RAILWAY CLUB.
Dec. 17. Secy., W. D. Crosman, Rookery Bldg., Chicago.

COLUMBIAN ENGINEERING SOCIETY.
Dec. 17. Secy., W. F. Hart, University Bldg., 15th and H Sts. N. W., Washington, D. C.

ENGINEERS' CLUB OF ST. LOUIS.
Dec. 18. Secy., W. B. Bryan, Turner Block.

AMERICAN SOCIETY OF CIVIL ENGINEERS.
Dec. 18. Secy., C. W. Hunt, 127 E. 23d St., New York.

ENGINEERS AND ARCHITECTS' ASSOCIATION OF SOUTHERN CALIFORNIA.
Dec. 18. Secy., F. Van Vleck, Los Angeles, Cal.

ASSOCIATION OF ENGINEERS OF VIRGINIA.
Dec. 18. Secy., J. A. Pilcher, Roanoke, Va.

BOSTON SOCIETY OF CIVIL ENGINEERS.
Dec. 18. Secy., S. E. Tinkham, City Hall.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.
Dec. 18. Secy., R. W. Pope, 26 Cortlandt St., New York.

CANADIAN SOCIETY OF CIVIL ENGINEERS.
Dec. 19. Secy., C. H. McLeod, Montreal.

ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.
Dec. 19. Secy., D. Carhart, Carnegie Library, Allegheny.

ENGINEERS' CLUB OF CINCINNATI.
Dec. 19. Secy., J. F. Wilson, Odd Fellows' Temple.

NEW YORK RAILROAD CLUB.
Dec. 19. Secy., John A. Hill, 256 Broadway, New York.

ENGINEERS' CLUB OF COLUMBUS, O.
Dec. 21. Secy., David Buel.

WESTERN SOCIETY OF ENGINEERS.
Jan. 1. Secy., Chas. J. Roney, Monadnock Block, Chicago.

CIVIL ENGINEERS' SOCIETY OF ST. PAUL.
Jan. 6. Secy., G. L. Annan, City Engineer's Office.

ENGINEERING SOCIETY OF WESTERN NEW YORK.
Jan. 6. Secy., Geo. R. Sikes, 122 Pearl St., Buffalo, N. Y.

CENTRAL RAILWAY CLUB.
Jan. 10. Secy., H. D. Vought, "Courier" Office, Buffalo, N.Y.

SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.
Jan. 16. Secy., F. A. Charplot, Macon, Ga.

ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.—At the regular monthly meeting held at Allegheny on Nov. 21, Mr. H. W. Fisher, Chief Engineer of the Underground Electric Cable Co., read a paper on "The Manufacture, Testing and Operation of Underground Electric Cables." He exhibited many specimens of cables and the various instruments used in testing the underground lines.

ENGINEERS' CLUB OF ST. LOUIS.—At the meeting of Nov. 20, Prof. W. B. Potter presented a paper on "Smoke Prevention." He gave a history of the Smoke Prevention Society of St. Louis, of which he is an active member, and described the results accomplished. Nearly all steam plants in St. Louis are now using some form of smoke-consuming device, and it is said that 70% of the smoke of the city has been eliminated. Professor Potter suggested the licensing of stokers in order to procure men of a higher grade of intelligence for such work.

ENGINEERS' CLUB OF PHILADELPHIA.—At the regular meeting, held Nov. 16, the paper of the evening on the subject, "Paint as a Protection for Iron," was presented by Messrs E. A. Custer and F. P. Smith. The requisites of a good rust-preventing paint are that it shall adhere firmly to the surface to which it is applied, that it shall not corrode the iron, that it shall be impervious to moisture and unaffected by atmospheric and other influences. The covering should consist of two coatings, the first to possess adhesive qualities, the second to be hard, elastic and moisture-proof.

L. F. Rondinella, Secy.

CIVIL ENGINEERS' CLUB OF CLEVELAND.—At the last meeting of this society a paper by Mr. Frank C. Osborn, on "Railroad Bridge Floors," was read by Mr. Bernard S. Green. Mr. Osborn treated the subject historically, noting the progress in the design of solid floors from the earliest times to the present. The requirements for a good railway bridge floor were given as follows: Accessibility for examination and painting, facilities for thorough and rapid draining, the use of shapes and sizes readily obtainable from the mills, simplicity of shop construction, simple and effective connection to girders.

Forrest A. Coburn, Secy.

INDIANAPOLIS ENGINEERING CLUB.—At the meeting held Nov. 23, Prof. W. F. M. Goss, of Purdue University, read a paper on "Limitation of Speed of Railway Trains." During the last two years great advances have been made in speed for short distances, or under special conditions. Still faster time may be anticipated, and it is not absurd to discuss the requirements for a schedule speed of 80 miles an hour—practically double the present rate. No one factor in speed will produce the result, but improvements must be made in all directions. Bridges, road crossings, and all parts of roadbed must require no slackening of speed. Curves must be gradual, computations suggesting about one mile radius. Track must be specially perfect in line, to prevent oscillation, which is greatly increased at high speeds. Gradients must be light, if of any considerable length. A grade of 10 ft. to the mile will increase the resistance 20% over that on a level, and should, doubtless, be the maximum for an 80-mile schedule. Stops should not be less than 100 miles apart. There must be special tracks for such traffic, practically free from local traffic, with block signals delivered to the engineer in his cab. Weight of train may be reduced, or power of locomotive increased, or both. An increase of about 30% in speed of trains is possible by

improvements above mentioned, without any change in either locomotive or trains. Piston speed must not be too great. Three hundred revolutions a minute assumed as a proper maximum will require drivers 9.4 ft. in diameter. One pair of drivers will then be sufficient, as it will be able to transmit as much cylinder power at 100 miles as two pairs of half the diameter at half the speed. Weight of train may then be 100 tons, assuming 20 lbs. a ton at high speed as the train resistance.

Chas. C. Brown, Secy.

## CONSTRUCTION NEWS.

### CONDENSED LIST OF CONTRACTS PENDING WITH DATE OF OPENING BIDS.

| Bids to be opened. | Work. | Place. | See Eng. News. |
|---|---|---|---|
| Dec. 6. | Brick sewer, | St. Louis, Mo. | Nov. 28 |
| Dec. 6. | Heating & Ventilating, | Buffalo, N. Y. | Nov. 28 |
| Dec. 6. | County jail, | Detroit, Mich. | Dec. 5 |
| Dec. 7. | Iron work for movable dams, | W. Va. | Nov. 14 Advertised, Eng. News, Nov. 14 to 28. |
| Dec. 7. | Improving streets, | Clifton, O. | Nov. 21 |
| Dec. 7. | Improving ventilating, | New York, N. Y. | Nov. 28 |
| Dec. 7. | Fire engine house, | Pittsburg, Pa. | Nov. 28 |
| Dec. 7. | Sewer, | Evansville, Ind. | Nov. 28 |
| Dec. 7. | Iron bridges (3), | Salina, Kan. | Nov. 28 |
| Dec. 9. | Electric light plant, | Cincinnati, O. | Nov. 21 |
| Dec. 9. | Gravel road, | Rockville, Ind. | Nov. 21 |
| Dec. 9. | Iron bridge, | Houston, Tex. | Nov. 28 |
| Dec. 9. | Gravel road, | Brazil, Ind. | Nov. 28 |
| Dec. 9. | Excavation, etc., | Jersey City, N. J. | Dec. 5 |
| Dec. 9. | Pipe sewers, | Syracuse, N. Y. | Dec. 5 |
| Dec. 9. | Repairing bridges, | Syracuse, N. Y. | Dec. 5 |
| Dec. 9. | Grading, etc., | Syracuse, N. Y. | Dec. 5 |
| Dec. 10. | Garbage disposal, | New York, N. Y. | Oct. 31 |
| Dec. 10. | Wharfwork at | Rimouski, Que. | Nov. 14 |
| Dec. 10. | Dredging in Christiana River, | Del. | Nov. 14 Advertised, Eng. News, Nov. 14 to Dec. 5. |
| Dec. 10. | Railway station, etc., | San Francisco, Cal. | Nov. 21 |
| Dec. 10. | Iron bridge, | Rapid River, Mich. | Nov. 21 |
| Dec. 10. | City hall, | Tell City, Ind. | Nov. 28 |
| Dec. 10. | Gasoline lamps, | Omaha, Neb. | Dec. 5 |
| Dec. 10. | Iron bridge, | Nebraska City, Neb. | Dec. 5 |
| Dec. 10. | Supplies for New York Navy Yard, | | Dec. 5 |
| Dec. 10. | Sewer, | Brooklyn, N. Y. | Dec. 5 |
| Dec. 10. | Sewer, | New York, N. Y. | Dec. 5 |
| Dec. 10. | Belgian block paving, | Brooklyn, N. Y. | Dec. 5 |
| Dec. 10. | Dormitories (2), | Boston, Mass. | Dec. 5 |
| Dec. 11. | Pumping engine, | Cleveland, O. | Nov. 14 Advertised, Eng. News, Nov. 14 and 21. |
| Dec. 11. | Piling (62,528 ft.), | St. Louis, Mo. | Nov. 21 |
| Dec. 11. | Iron bridge, | New Orleans, La. | Nov. 21 |
| Dec. 11. | Electric light plant, | Mitchell, Ind. | Nov. 21 |
| Dec. 11. | Bridge Superstructure, | Toledo, O. | Nov. 21 |
| Dec. 11. | Iron bridge, | Camden, N. J. | Nov. 28 |
| Dec. 11. | Brick paving, | Lexington, Ky. | Nov. 28 |
| Dec. 11. | Steel cage, | Orange City, Ia. | Dec. 5 |
| Dec. 11. | Fire hose (9,000 ft.), | New York, N. Y. | Dec. 5 |
| Dec. 11. | Grading, etc., | Cambridge, Mass. | Dec. 5 |
| Dec. 11. | Flagging, | Brooklyn, N. Y. | Dec. 5 |
| Dec. 11. | Steel bridge, | Louisville, Ky. | Dec. 5 |
| Dec. 12. | Building superstructure, | Allegheny, Pa. | Nov. 21 |
| Dec. 12. | Arc lights (80), | Shreveport, La. | Nov. 21 |
| Dec. 12. | Water bonds ($60,000), | Nevada City, Cal. | Nov. 28 |
| Dec. 12. | Laying water pipes, | Chicago. | Dec. 5 |
| Dec. 12. | Fire engine house, | Philadelphia, Pa. | Dec. 5 |
| Dec. 12. | Iron bridge, | Kansas City, Mo. | Dec. 5 |
| Dec. 13. | Pipe sewer, | Valparaiso, Ind. | Dec. 5 |
| Dec. 14. | Reservoir, etc., | Tarrytown, N. Y. | Nov. 21 Advertised, Eng. News, Nov. 21 to Dec. 12. |
| Dec. 14. | Water-works, | Riverside, O. (Cincinnati). | Nov. 21 |
| Dec. 14. | Steel bridges (2), | Denver, Colo. | Nov. 28 |
| Dec. 14. | Tunnel (2,100 ft.), on Pennsylvania R. R. | | Dec. 5 Advertised, Eng. News, Dec. 5. |
| Dec. 14. | Penn. R. R. ext'ns (3), | Philadelphia, Pa. | Dec. 5 Advertised, Eng. News, Dec. 5. |
| Dec. 16. | Water-works system, | Greenville, Miss. | Nov. 14 Advertised, Eng. News, Nov. 14 to Dec. 5. |
| Dec. 16. | Macadamizing. | Cincinnati, O. | Nov. 21 |
| Dec. 16. | Cast iron pipe, | Atlantic City, N. J. | Dec. 5 Advertised, Eng. News, Dec. 5 and 12. |
| Dec. 16. | Laying water pipe, | Atlantic City, N. J. | Dec. 5 Advertised, Eng. News, Dec. 5 and 12. |
| Dec. 16. | Removal of snow, | New York, N. Y. | Dec. 5 |
| Dec. 16. | Artesian well, | Antonio, Colo | Dec. 5 |
| Dec. 16. | Stone residence, | Victoria, Tex. | Dec. 5 |
| Dec. 16. | Iron bridge, | Kansas City, Mo. | Dec. 5 |
| Dec. 16. | Valves, etc., | Atlantic City, N. J. | Dec. 5 Advertised, Eng. News, Dec. 5 and 12. |
| Dec. 16. | Cofferdam, | Syracuse, N. Y. | Dec. 5 |
| Dec. 16. | Paving, | Syracuse, N. Y. | Dec. 5 |
| Dec. 16. | Garbage disposal (4 yrs.), | Allegheny, Pa. | Dec. 5 |
| Dec. 17. | Steel rails (4,000 tons), | Ottawa, Ont. | Oct. 24 |
| Dec. 17. | Light fixtures, | Rochester, N. Y. | Nov. 28 |
| Dec. 17. | Fireproof shutters, | New York, N. Y. | Nov. 28 Advertised, Eng. News, Nov. 28 and Dec. 5. |
| Dec. 18. | Water-works, | Winton Place, O. | Nov. 21 |
| Dec. 18. | Water-works system, | Falmouth, Ky. | Nov. 28 |
| Dec. 18. | Street cleaning, | Cleveland, O. | Nov. 28 |
| Dec. 18. | Addition to hospital, | Poughkeepsie, N.Y. | Nov. 28 |
| Dec. 18. | Pipe sewers, | Greenfield, Ind. | Dec. 5 |
| Dec. 18. | Bridge, | Indianapolis, Ind. | Dec. 5 |
| Dec. 18. | Bonds ($100,000), | Houston, Tex. | Dec. 5 |
| Dec. 19. | Boiler house, etc., | Los Angeles, Cal. | Oct. 31 |
| Dec. 20. | Canal (30 miles), | Baltimore, Md. | Nov. 28 Advertised, Eng. News, Nov. 28. |
| Dec. 20. | Electric lighting, | Medina, N. Y. | Dec. 5 |
| Dec. 21. | Steel & ironwork for U. S. bldg., | N. Y. | Nov. 28 |
| Dec. 23. | U. S. public building work, | Buffalo, N. Y. | Dec. 5 Advertised, Eng. News, Dec. 5 and 12. |
| Dec. 23. | Library building, | Hoboken, N. J. | Dec. 5 |
| Dec. 23. | Tunnel (6,300 ft.), | Colorado Springs, Colo. | Dec. 5 Advertised, Eng. News, Nov. 21 to Dec. 19. |
| Dec. 23. | Heating & ventilating, | Canton, O. | Nov. 28 |
| Dec. 26. | Water supply, Ft. Hall Ind. Res., | Idaho. | Nov. 28 |
| Dec. 26. | Removal of wreck, | Boston, Mass. | Dec. 5 |
| Dec. 26. | Breakwater (200 ft.), | Agate Bay, Minn. | Dec. 5 |
| Dec. 26. | Paving bonds ($15,000), | Westwood, O. | Dec. 5 |
| Dec. 27. | Lamps (750), | New York, N. Y. | Dec. 5 |
| Dec. 27. | Water pipe, etc., | Hatfield, Mass. | Dec. 5 Advertised, Eng. News, Dec. 5 to 19. |
| Jan. 2. | Garbage crematory, | Dayton, O. | Dec. 5 |
| Jan. 6. | Bridge, | Astoria, Ore. | Nov. 21 |
| Jan. 7. | Street ry. franchise, | New Orleans, La. | Oct. 17 |
| Jan. 7. | Pumping engine, | Red Wing, Minn. | Nov. 28 |
| Jan. 7. | Dredging, | Collingwood (Ont.) Harbor. | Dec. 5 |
| Jan. 7. | Iron bridge, | Annapolis, Md. | Dec. 5 |
| Jan. 13. | Plans for court house, | Galveston, Tex. | Nov. 21 |
| Mar. 3. | Street railway franchise, | New Orleans. | Dec. 5 |

### RAILWAYS.

#### East of Chicago.

BELLEFONTE & CLEARFIELD.—Incorporated in Pennsylvania to build a railway from Milesburg, Centre county, to Clearfield, a distance of 55 miles; capital stock, $1,100,000; incorporators, Chas. H. Wilhelm, Pres., Reading, Pa.; James Harris, David M. Butts, John J. Walsh, Henry Brookerhoff and L. T. Munson, all of Bellefonte; A. V. Hoyt, Phillipsburg. Principal place of business, Bellefonte, Pa.

CANTON & WOOSTER.—A press report states that surveys for this road have been commenced. The route proposed connects Justus, O., on the Cleveland, Canton & Southern, near Canton, with Wooster, on the Baltimore & Ohio. It will cross the Cleveland, Akron & Columbus near Apple Creek. The completion of this railway will give a direct route from Wooster to Zanesville, via the C., C. & S.

CHESTER & STATE LINE.—Incorporated in Pennsylvania to build a railway from Chester, Delaware county, to Delaware state line; capital stock, $50,000; directors, John E. Thompson, St. Louis, Mo.; Wm. Simpson and Wm. P. Simpson, Overbrooke, Pa. Pres., John E. Thompson, St. Louis, Mo.; principal place of business, Overbrooke, Pa.

HAMMOND & BLUE ISLAND.—At a recent meeting of the stockholders of this company, it was voted to increase the capital stock from $100,000 to $400,000. Reports were received setting forth that the 14 miles of road would be finished Jan. 1, 1896, and that track laying was progressing encouragingly. The road will be a belt line, extending from Hammond, Ind., to Blue Island, Ill., as described in our issue of Oct. 24. All directors and officers are connected with the Hammond Packing Co., Hammond, Ind.

HUDSON RIVER & WASHINGTON COUNTY MIDLAND.—Permission has been granted the above company by the state railway commissioners of New York to build a line between Greenwich, Washington county, N. Y., and Schuylerville, Saratoga county, a distance of about eight miles. Albany capitalists will build the road.

JAMESTOWN & LAKE ERIE.—The directors of this railway, formerly the Chautauqua Lake, have decided to begin work at once on the new section to be built to Falconer, N. Y., connecting with the Dunkirk, Allegheny Valley & Pittsburg at that place. At present trains run over the tracks of the Western New York & Pennsylvania from Mayville to Brocton, to connect with the trunk lines. The proposal to discontinue the operation of the line from Jamestown to Mayville and beyond is being seriously considered, since the old road has never been placed on a paying basis. Gen. Man., E. T. Haines, Jamestown, N. Y.

LAKE ERIE & DETROIT RIVER.—According to press reports from Detroit and other points, the project of the above railway to build an extension from Ridgetown, Ont., its present terminus, to St. Thomas, Ont., embraces in reality a much larger plan of operations. It is now proposed to build the extension to Fort Erie, Ont., opposite Buffalo, and rumor has it that the Canadian Pacific is the promoter of the enterprise.

LEHIGH VALLEY.—The contracts for a portion of the work on the extension of the Easton & Northern, from Easton to the main line at South Easton, are reported to have been let. James Smith, of Easton, will do the masonry work on the bridge across the Lehigh, and the Union Iron Works, of Athens, Pa., will build the superstructure.

It is reported that the Middlesex Valley road, extending from Geneva, N. Y., to Naples, 29 miles westward, has been bought by the Lehigh Valley, and will be utilized in connection with some new line that it intends building near Conesus Lake.

PENNSYLVANIA.—Bids are asked by Wm. H. Brown, Ch. Engr., Philadelphia, until Dec. 14, for the following work, as noted in our advertising columns: For the completion of the new line at Radebaugh, including a tunnel 2,100 ft. long, and for a new line between Conemaugh Furnace and Ninevah, on the Pittsburg Division; W. R. Michie, Asst. Engr., Johnstown, Pa. Grading and masonry for the two tracks on the new line between Lilly and Portage stations, on the Pittsburg Division; C. S. d'Invilliers, Asst. Engr., Altoona, Pa. Grading and masonry for the changes of line from Kinzers to a point west of Gordonville, and for the new line west of Rheems station; W. B. Prichett, Asst. Engr., Mount Joy, Pa.

PHILADELPHIA & ESSINGTON.—Incorporated in Pennsylvania, Nov. 26, to build a railway from Essington, Delaware county, to Penrose Ferry Bridge, Philadelphia; capital stock, $60,000; Pres., Wm. P. Simpson, Overbrooke, Pa.

#### Southern.

LAFAYETTE.—A press report states that the Lafayette Land Co. is surveying a route for a new railway from Big Creek Gap, Tenn., via Cumberland Gap, to Norton, Va., and that 18 miles of grading have been let.

LA FOLLETTE.—This company, whose headquarters is at La Follette, Tenn., writes us that all surveys for its road have been made, and the right of way almost entirely secured. Contracts for the work have been let Fitzgerald, Cushing & Co., of Chicago, having that for the construction of the 18 miles between La Follette & Middlesborough, it is said. The projected route is 80 miles in length, from Knoxville to La Follette, with branches to Jellico and Middlesborough, Ky. Pres., H. M. La Follette, La Follette, Tenn.

MOBILE & GIRARD.—This road was sold at auction under foreclosure at Girard, Ala., last week, and was bought by Julian T. Davies, of New York, for $1,000,000. The road is 133 miles long, and extends from Columbus to Seabright, Ala.

TALLASSEE & MONTGOMERY—Watkins & Hardaway, contractors, Birmingham, Ala., write us concerning the progress of the above road, that grading is practically finished, and the entire work nearing completion. The piers for the Tallapoosa River bridge are 80 ft. high, and almost ready for the iron superstructure, which will be received in a few days and erected at once. Tracklaying will begin in about 30 days.

TIFTON & NORTHEASTERN.—Arthur Pew, Tifton, Ga., writes us that he has just taken charge of the 12-mile extension of the above railway, to Fitzgerald, Ga. He also states that he has recently completed a 15-mile road for the Peace River Phosphate Co. in southern Florida.

#### Northwest.

CHICAGO, ROCK ISLAND & PACIFIC.—It is stated that this road intends building its own line from either Plattsburg or Edgerton, in Clinton county, Mo., to Kansas City. The company now reaches Kansas City from Cameron over the tracks of the Hannibal & St. Joseph R. R. Gen. Man., W. H. Truesdale, Chicago.

DES MOINES & KANSAS CITY.—This company is said to have completed every arrangement for the extension of the line from Cainsville, Mo., to Kansas City in the spring.

DULUTH, MISSABE & NORTHERN.—It is stated on very good authority that extensive changes are soon to be made on this railway. The road is to be extended west from Columbia Junction for a distance of 240 miles to reach the Red River Valley at Moorhead. Then the road will probably be built north to the Canadian border, paralleling the Great Northern. The new railroad will be almost a straight line from the wheat fields to Duluth, the nearest lake port. The road is controlled by John D. Rockefeller and Standard Oil interests.

ILLINOIS CENTRAL.—J. F. Wallace, Ch. Engr., Chicago, writes us disclaiming any knowledge of the rumored extension from La Salle to Ottawa, Ill

IOWA CENTRAL.—A reported improvement on this line is an extension from Oskaloosa, its present western terminus, to Des Moines. This step has been contemplated for several years, and it is thought that it will be carried out in the spring. About eight miles of new track will be built from Pella to Howell. The tracks of the Chicago, Rock Island & Pacific will be brought into service from Oskaloosa to Pella, and from Howell to Des Moines the trains will run over the Wabash road. Gen. Man., L. M. Martin, Marshalltown, Ia.

OTTUMWA, EDDYVILLE & ALBIA.—It is reported that a vigorous movement has been organized by the citizens of the three places above mentioned, to incorporate in Iowa a railway company under the above name. Considerable financial backing has already been assured.

ST. LOUIS, PERRY & CHICAGO.—According to despatches from St. Louis, work upon this long-projected railway has begun, surveyors having started their line at Griggsville, Ill., and are working towards Perry. The route will be chosen through McDonough, Schuyler, Brown, Pike and Calhoun counties. The reason for the unwonted activity is said to be the successful disposal of the bonds of the company. The chief promoter of the enterprise is Col. J. M. Piper, of St. Louis.

#### Southwest.

FORT WORTH STOCK YARDS BELT.—Incorporated in Texas on Nov. 27 to construct a railway around the city of Fort Worth, to begin at a point on the main line of the Texas & Pacific Ry., about 2½ miles northeast of the city. In its course around the city the route passes through the works of the Fort Worth Stock Yards Co., and touches all lines entering Fort Worth. The total distance is seven miles. The capital stock is $100,000, and the incorporators are G. W. Simpson and S. N. Niles, Boston, Mass.; C. W. Simpson, Chicago, Ill.; Walter Ross, W. E. Skinner, C. H. Silliman, R. A. Green, Jr., and N. Harding, Fort Worth.

TEXAS CENTRAL.—This company has commenced the work of building terminal facilities in East Waco, Tex., preparatory to the extension of that line from Ross into Waco. A large force of men is engaged in grading the extensive property of the company in East Waco, and preparing it for the construction of tracks and buildings. The investment of the company in East Waco is placed at $100,000. Ch. Engr., Jos. McWilliams, Waco.

#### Rocky Mt. and Pacific.

SAN FRANCISCO & SAN JOAQUIN VALLEY.—W. B. Story, Jr., Ch. Engr., 321 Market St., San Francisco,

informs us of the present condition of the work, that surveys have been completed from Stockton to Bakersfield, right of way secured for 35 miles, grading finished from Stockton to the Stanislaus River, 25 miles, and track laid for 20 miles. The total projected length is 250 miles, from San Francisco through Stockton, Merced, and Fresno to Bakersfield. The capital for construction is all secured.

ROSSLAND.—A report from Rossland, B. C., states that work is to begin at once upon the narrow-gage ore railway from Rossland to Trail. The surveys for the line have been completed, and things are now almost in readiness for actual construction. Bids for the construction have been opened. The line proper will be built as a narrow gage, but the bridges will be standard, and the ties may be also, with the possibility of a future railway, standard gage throughout. Those who are back of the enterprise hope to secure an extension of the Nelson & Fort Sheppard from Beaver Creek to a point opposite Trail, on the east side of the Columbia River. The engineers who are to conduct this work are F. P. Gutelius, Butte, Mont.; J. D. & W. R. Porter, recently with the Kaslo & Slocan Ry.

## STREET AND ELECTRIC RAILWAYS.

CHESTER, N. H.—Surveys have been made for the Chester & Derry Electric Ry. Prof. Cassius S. Campbell, of Derry, N. H., is interested.

AMHERST, MASS.—H. L. Pierce, of the Boston Construction Co., Boston, is making estimates for a projected electric railway between this city, Northampton and North Amherst. John C. Hammond, of Northampton, Mass., is interested.

BEVERLY, MASS.—F. S. Dodge, son of Mrs. J. S. Dodge, of Beverly, is reported to have been commissioned by the Hawaiian government to secure information in regard to equipping the street railways of Honolulu with electricity. Mr. Dodge has already visited a number of plants in this country.

STAMFORD, CONN.—It is stated that the New York, New Haven & Hartford R. R. Co. proposes to equip the Stamford St. Ry. with electricity. Address Colonel Heft, Supt. Electrical Dept., N. Y., N. H. & H. R. R. Co., New Haven.

ALBANY, N. Y.—John W. Van Valkenburg, Pres., 73 State St., Albany, writes us that the Albany, Helderberg & Schoharie Electric Ry. Co. has completed surveys for its road, 30 miles long, but the right of way has not yet been secured. The capital for the construction has been subscribed. It has not been decided when to let the contracts. The road will be operated by steam, electricity or compressed air. Ch. Engr., Geo. Yost, 73 State St.

BUFFALO, N. Y.—The aldermen on Nov. 30 voted in favor of granting a franchise to the Buffalo Traction Co. to construct 66 miles of electric railway in this city. Thos. Johnson, of Lorain, O., and Wilson S. Bissell, of Buffalo, are interested.

ELMIRA, N. Y.—It is stated that the Elmira & Horseheads St. Ry. Co. proposes to extend its electric road from Horseheads to Montour Falls, N. Y., at an estimated cost of $200,000.

NEW ROCHELLE, N. Y.—The Westchester Electric R. R. Co., which is controlled by the Union Ry. Co., has been granted a franchise for extending its road into this city.

NIAGARA FALLS, N. Y.—The Niagara Falls & Lewiston R. R. Co. has applied for permission to extend its electric railway.

SYRACUSE, N. Y.—The Syracuse, Pleasant Beach & Baldwinsville Electric Ry. Co. has been organized by the Pleasant Beach Electric Park Co. Pres., E. A. Powell, Syracuse; Vice-Pres., A. T. Hotaling, Baldwinsville, N. Y.; Secy. and Treas., I. M. Price, Philadelphia, Pa.

GLEN RIDGE, N. J.—The North Jersey St. Ry. Co. has petitioned the council for a franchise for its electric road through this place.

ALLEGHENY, PA.—The Allegheny & Evergreen St. Ry. Co. has been incorporated, with a capital stock of $30,000, of which $12,000 is paid in. Andrew Pafenbach, 254 Federal St., Allegheny, is interested.

BROWNSVILLE, PA.—The Pittsburg & Monongahela Traction Co. has been incorporated to construct a street railway between West Elizabeth and Brownsville; capital stock, $12,000. Pres., M. G. Bulger, Brownsville; director, H. C. Johnson, Pittsburg.

READING, PA.—The United Traction Co. has been organized, and it is stated that a charter is to be applied for at once. The incorporators are Wm. R. McIlvain, Henry C. England, James A. O'Reilly, Samuel E. Rigg and Oliver S. Geiger. Its capital stock is $400,000. It is proposed to operate all the street railways of the Reading Traction Co.'s system, and to provide additional capital to make desirable improvements.

WEST CHESTER, PA.—The Pottstown & West Chester Electric St. Ry. Co. was incorporated Nov. 27 to build a line between South Pottstown and West Chester, a distance of 22½ miles; capital stock, $500,000; Pres., Joseph B. Robinson.

BALTIMORE, MD.—The large cotton mill of the Powhattan Construction & Improvement Co., at Powhattan, Baltimore county, was destroyed by fire Dec. 2; reported loss, $50,000; insurance, $37,000. About 100 men will be without work until the mill can be rebuilt.

FREDERICK, MD.—The following contracts have been awarded for constructing 3½ miles of the Frederick & Middletown Electric Ry., divided into five sections: First and second sections from Middletown, Lewis F. Kefauver; third and fourth, D. Edward Kefauver; fifth, from the summit of Catoctin Mountain to the Spring, Mr. Main, of that vicinity. Pres., Geo. Wm. Smith; Secy., U. A. Sharretts; Treas., Herman L. Routzatin.

HAGERSTOWN, MD.—Press reports state that the Hagerstown & Potomac Electric Ry. Co. has awarded the contract to build its railway in Hagerstown, and extensions to Williamsport and Funkstown, to the Harrisburg Construction Co. S. Ritter Ickes and J. E. Kaepp, of the construction company, are making preliminary surveys and arrangements for the work. It is stated that nearly all of the bonds of the railway company, amounting to $100,000, have been sold.

PORTSMOUTH, VA.—The executive committee of the Portsmouth St. Ry. Co., composed of Gen. J. G. Sigfried, Maj. John F. Finney and J. W. Beecher, has been authorized to make all necessary arrangements for equipping the road with electricity and extending it. The engineer will soon proceed to lay out the routes.

NEW ORLEANS, LA.—Bids are asked until March 3 for the purchase of a 50-year street railway franchise. D. A. Rose, Clk. Council; John Fitzpatrick, Mayor.

LOUISVILLE, KY.—Rowland Cox, Ch. Engr., Taylorsville, Ky., writes us that surveys are about completed for the Louisville, Mount Washington & Fairfield Electric R. R., 32 miles long. The right of way is all secured. Pres., W. B. Hoke, Louisville.

XENIA, O.—It is stated that the Rapid Transit Co., of this city, has awarded the contract for the construction of its electric road from Xenia to Springfield, 22 miles, to the Geo. H. Mellen Co., 111 Liberty St., New York, N. Y. J. J. Little, of Xenia, is interested.

ANDERSON, IND.—It is stated that bids are soon to be asked for constructing the projected electric road between Anderson and Indianapolis. Chas. H. Henry, of Anderson, is interested.

FORT WAYNE, IND.—C. E. Everett, Pres., Fort Wayne, writes us that the Fort Wayne, Lake Everett & Columbia City St. Ry. Co. has not yet secured the franchise for the terminal for its road, 25 miles long, in this city. Ch. Engr., H. E. Ficher, Fort Wayne.—The Fort Wayne Consolidated Ry. Co. has been incorporated with a capital stock of $2,000,000; directors, John H. Bass, M. S. Robinson, James M. Barrett, John J. Shepherd, Andrew Squire, Charles Gerke and Samuel L. Morris. The company will operate the electric street system of Fort Wayne.

DETROIT, MICH.—Prof. R. L. Sackett, Richmond, Ind., writes us that surveys for the proposed Detroit & River St. Clair R. R. between Chesterfield, Baltimore and Algonac, Mich., 32 miles, were made in September. Smith Bros., of Algonac, were awarded the contract for constructing the road, which has been finished to Baltimore, five miles. All the right of way has not yet been secured. The road will be a feeder to the Grand Trunk R. R. at Chesterfield. Engrs., Wm. H. Ashwell, Home Bank Bldg., Detroit. Lester B. French, 12 Whitney Bldg., is interested.

WYANDOTTE, MICH.—H. C. Burke, C. W. O'Brien and Alex. E. Riopelle, representing the Ecorse Electric St. Ry. Co., Ecorse, Mich., have been granted a franchise for its road in this place.

CHICAGO, ILL.—The City Ry. Co. is reported about to issue $2,000,000 of capital stock for constructing about 35 miles of extensions to its electric road.

PEORIA, ILL.—The Central Ry. Co. has voted to increase its capital stock from $600,000 to $750,000 for improving and extending its electric road.

MILWAUKEE, WIS.—The receivers of the Milwaukee St. Ry. Co. have been granted authority to purchase an engine and two generators, to cost $25,940, and 30 new cars, at a cost of $2,400 each.

SIOUX CITY, IA.—The Central Traction Co. has been incorporated to operate a street railway; capital stock, $500,000; incorporators, Howard S. Baker, C. M. Swan and Geo. P. Morris.

KANSAS CITY, MO.—T. J. Fry, Man. West Side St. Ry. Co., writes us that the company will soon ask for a franchise for its electric road from Kansas City to Westport, Mo., 15 miles. Pres., A. E. Stilwell, Kansas City.

SANTA MONICA, CAL.—Work will soon be begun on the Los Angeles & San Monica Electric Ry., according to reports. Thos. H. James, Town Engr., is making surveys.

## ELECTRIC LIGHT AND POWER.

HULL, MASS.—On Nov. 30 it was voted to appropriate $5,000 for additions to the electric light plant and $2,000 for operating.

GROTON, CONN.—The question of electric lighting is being considered.

BROOKLYN, N. Y.—The city proposes to purchase the electric light plant belonging to the Gravesend Common Lands Commission for $68,000. If this is done, it is probable that $15,000 will be spent to complete the equipment of the plant.

LIVONIA, N. Y.—The question of constructing an electric light plant and water-works is being considered.

MEDINA, N. Y.—Bids are asked until Dec. 20 for furnishing 55 arc lights for three or five years. J. W. Cooper, Village Clk.

OWEGO, N. Y.—It is reported that the Owego Gaslight Co. proposes to erect an electric light plant.

WOLCOTT, N. Y.—Omar M. Curtis has applied to the village board for a franchise for an electric light plant.

STOCKTON, N. J.—The construction of an electric light plant is being considered by the council.

RALEIGH, N. C.—Several cotton mills and other manufacturing plants in this state are considering the advisability of putting in electric light and other electric equipment. Address M. J. Gorman, Raleigh.

LAKE CITY, FLA.—It is reported that the Lake City Water & Light Co. has secured a 10-year franchise to light the city, the plant to be in operation by May 1.

MALVERN, O.—It is stated that this place will issue bonds for electric lights.

NILES, O.—It is stated that the city water and light trustees are considering the question of putting an additional 50-light dynamo in the electric light plant.

WELLINGTON, O.—The construction of an electric light plant is under contemplation, according to reports.

FRANKPORT, IND.—James A. Price, Cy. Clk., writes us that no electric light plant is proposed at present. A. J. Hammond, Cy. Engr.

COPEMISH, MICH.—It is reported that the question of putting in electric lights is being considered.

DURAND, MICH.—We are informed that this city is putting in an electric light plant for street and commercial lighting. Contract awarded to the Fort Wayne Electric Corporation, Fort Wayne, Ind., for the electrical apparatus, and to Arbuckle, Ryan & Co., of Toledo, O., for the steam plant. Engrs., Humphrey & Carr, of Detroit.

CHICAGO, ILL.—The Lincoln Park board has decided to construct an electric plant of 400 lights, at an estimated cost of $50,000. Engr., A. A. Babcock; Andrew Crawford, Pres. Park Bd.

DECATUR, ILL.—John H. Culver, of Decatur, has been granted a 20-year franchise for an electric light plant, to cost $10,000.

PLANO, ILL.—The council has granted a five-year franchise for an electric light plant to Henning & Ross, of Chicago.

ARCADIA, WIS.—The Arcadia Milling Co. is considering favorably the question of putting in an electric plant for lighting the entire town, according to reports.

DYERSVILLE, IA.—A committee has been appointed to consider the advisability of putting in an electric light plant, according to reports.

LEBANON, MO.—It is reported that the water-works, electric light and electric street railway plants belonging to the Lebanon Light & Water Co. were sold at auction Nov. 28 to Edmon Crebs, of Fairfield, Ill., for $200,000. The plants originally cost about $325,000. It is understood that the plants will be improved and put in better working order. Mr. Crebs was the only bidder.

LOWELL, MO.—The town is discussing the question of a municipal light plant. Bonds will probably be issued.

ROSSLAND, B. C.—The new water company proposes to establish an electric light plant. W. S. Norman, of Spokane, Wash., and Patrick Clarke, J. A. Finch, and others, of the War Eagle Mine, Rossland, are interested.—Stack & McDonald, of Rossland, are also considering the question of constructing an electric light plant.

NEW COMPANIES.—Woodhaven Electric Light Co., Jamaica, N. Y.; $25,000; J. H. Smith, James Cochran, J. C. Milligan, Brooklyn, N. Y.; A. J. Cordier, Woodhaven; E. M. Martin, Elizabeth, N. J.

Meyer Storage Battery Co., Chicago, Ill.; $50,000; Fritz Meyer, E. W. Adkinson, David M. Ball.

Sheboygan Lamp Co., Sheboygan, Wis.; $40,000; to manufacture electric light appliances; W. C. Johann, James E. Collins, Sheboygan.

Elwood City Motor Co., Elwood City, Pa.; $3,000, with $300 paid in; to manufacture motors and other electrical appliances; Treas., Robt. A. Todd, Elwood City.

American Signal Co., Chicago, Ill.; $100,000; to manufacture and sell electrical and other machinery and appliances; Charles S. Arnold, Joseph P. Eames, John T. Bailey.

Sacramento Electric Power & Light Co., Sacramento, Cal.; $1,500,000; Albert Gallatin, Andrew J. Ralston, Horatio P. Livermore, Chas. P. Livermore, Joshua Barker.

Port Jefferson Electric Light Co., Port Jefferson, N. Y.; $7,500; W. T. Wheeler, of the Port Jefferson Milling Co.; M. L. Chambers, Wilson Ritch, Simon Dreyer, all of Port Jefferson.

Western Electric Transit & Power Co., Boulder, Colo.; $100,000; Edwin B. Goodwin, H. J. Danford, M. K. Meholiin, Bernard Mallor, Frank Kline, Oliver J. Cheney, Boulder, Colo.

Phoenix Electric Co., Phoenix, N. Y.; $15,000; Robert L. S. Sloan, Orin F. Gaylord, Elisha B. Powell, Oswego, N. Y.; S. Dana Greene, Edward S. Taft, Phoenix; Geo. B. Leonard, Syracuse, N. Y.

Long Island Illuminating Co.; to manufacture gas and electricity for use in Flatlands, Jamaica and Richmond Hill; $100,000; Charles A. Lockwood, Jamaica; R. F. Rhodes, J. H. Holmes, J. S. Jones, E. E. Seaman, Brooklyn.

St. Mary Piping Co., Spokane, Wash.; $500,000; to erect and operate electric light and power stations, and engage in other enterprises; H. S. Voorhees, J. L. Willson, R. H. Voorhees, J. H. Burke, T. E. Jefferson, H. L. Willson.

Niagara Electric Chemical Co., New York, N. Y.; $100,000; Hamilton Y. Castner, London, Eng.; Jacob Hasslacher, 73 Pine St., New York city; Franz Roesseler, Perth Amboy, N. J.; Wm. A. Haman, Mount Vernon, N. Y.

Perfection Light Co., Cincinnati, O.; $100,000; to deal in machines, apparatus, and appliances for the utilization of petroleum and its products, for lighting and heating purposes; A. J. English, James L. Foley, Louis K. Marty, Lewis M. Hosea, Louis B. Foley.

Bergmann Electric Co., New York, N. Y.; to manufacture appliances to produce electricity, gas, steam or heat, and to distribute the same; $500,000; Sigmund Bergmann, Harry F. Bailey, Edwin Lavens, Philip H. Klein, Jr., Frederick La Roche, New York city.

Havana Abattoir Co., Havana, Cuba; $1,000,000, with $1,000 paid in; incorporated Nov. 27 in Jersey City, N. J., to operate plants by horse, steam or electricity, and also transmit electricity for light, heat and power; Horace Holden, East Orange, N. J.; J. W. H. James, New Amsterdam Hotel, New York, N. Y.; Geo. W. McNulty, New York.

## BRIDGES.

HOWLAND, ME.—It is stated that a new iron bridge, to cost about $40,000, is to be built between Howland and Penobscot. J. H. McNamera, of Oldtown, Me., is to be in charge of the construction.

BUFFALO, N. Y.—We are informed that it is not yet decided when bids will be received for the construction of the Porter Ave. bridge, in this city, noted last week. Plans have been sent to the state engineer at Albany, and bids will be advertised for by the superintendent of public works probably within four or five weeks. Des. Engr., F. M. Sylvester, of the Buffalo Engineering Co., Erie County Savings Bank Bldg., Buffalo.

HEMPSTEAD, N. Y.—It is reported that a company will soon be organized to build a trestle bridge from Hog Island Beach, on Barnum Island, to Long Beach. The structure will be crossed by an electric railway and bicycle path. Thos. G. Knight, Austin Cornwell, Wm. H. Jones, John De Mott, and other property owners of this place are interested.

SYRACUSE, N. Y.—Bids are asked until Dec. 9 for repairing two stone bridges over Onondaga Creek. H. F. Stephens, Cy. Clk.

HARRISBURG, PA.—The Harrisburg & Mechanicsburg Electric Ry. Co. has submitted a proposition to the county commissioners to erect a steel bridge at West Fairview, if the county will give $1,000 towards the project. Fred Alleman and Joseph Kauffman are interested.

NEW BRIGHTON, PA.—We are informed that the Overgrade Bridge Co. is making surveys for its new structure over the Beaver River at this place, and plans will be prepared as soon as possible. It will be built strong enough to permit the traction company's cars to run at full speed, and will pass overhead all existing railway tracks. Solicitor, John S. Wendt, St. Nicholas Law Bldg., Pittsburg.

PITTSBURG, PA.—Maj. R. L. Hoxie, U. S. Engr., gave a hearing Nov. 26 on the question of plans for the proposed bridge over the Youghiogheny River at Sutterville.

ANNAPOLIS, MD.—Bids are asked until Jan. 7 for building a 50-ft. iron bridge over Furnace Branch, Glen Burnie. A. K. Starlings, Clk. County Comrs., Annapolis.

MOBILE, ALA.—The following bids were received Nov. 20 for constructing three steel bridge spans and approaches, as advertised in Engineering News; Geo. E. Sage, Pres. Comrs.; Engrs., Nicol & Ezzell, Mobile; (1) being with masonry approaches; (2), with steel approaches:

| | 1. | 2. |
|---|---|---|
| Alabama Bridge Co., Anniston, Ala. | $6,200 | $6,695 |
| Groton Bridge & Mfg. Co., Groton, N. Y. | 6,245 | 6,790 |
| Geo. E. King Bridge Co., Des Moines, Ia. | 6,229 | 6,731 |
| Southern Bridge Co., Birmingham, Ala. | 6,241 | 6,745 |
| Grant Wilkins, Atlanta, Ga. | 7,132 | 7,313 |
| Wrought Iron Bridge Co., Canton, O. | 6,210 | 6,700 |
| Brackett Bridge Co., Cincinnati, O. | 6,921 | 8,180 |
| Virginia Bridge & Iron Co., Roanoke, Va. | 6,100 | 6,600 |
| Edgar-Thompson Fdy. & Mach. Co., Mobile | 6,921 | 8,180 |
| Geo. H. Crafts, Atlanta, Ga. | 6,218 | ..... |
| Watkins & Hardaway, Birmingham, Ala. | 6,144 | 6,649 |
| Youngstown Bridge Co.,* Youngstown, O. | 5,200 | 5,700 |
| King Bridge Co., Cleveland, O. | 6,317 | 6,821 |
| St. Louis Bridge & Iron Co., St. Louis | 6,352 | 6,871 |
| Variety Iron Works, Cleveland, O. | 6,100 | 6,600 |

* Awarded contract at $5,700.

LOUISVILLE, KY.—Bids are asked until Dec. 11 for constructing a steel bridge over Fern Creek on the Vaughan Mill road, about three miles south of Stine. C. Fegenbush, Comr.; Hart Vance, County Surv., Louisville.

INDIANAPOLIS, IND.—Bids are asked until Dec. 18 for building a bridge over White River at Raymond St., according to reports. Joseph T. Hunter, Clk. Bd. County Comrs.

INDIANAPOLIS, IND.—We are informed that the board of public works has rejected the bids for the construction of the Pleasant Run bridge, estimated to cost about $5,000. The bids for this work were published in our issue of last week. New bids will probably be asked for in January. B. J. T. Jeup, Acting Cy. Engr.

WYANDOTTE, MICH.—Plans have been completed for a $150,000 bridge from Grosse Isle to Wyandotte, according to reports. E. W. Voigt, Detroit, is interested.

DAVENPORT, IA.—Chas. F. Loweth, 94 East Main St., St. Paul, Minn., is preparing plans for the substructure for the proposed railway bridge over the Mississippi River from this city to Rock Island, Ill.

KANSAS CITY, MO.—Bids are asked until Dec. 12 for constructing an 80-ft. wrought iron bridge, and until Dec. 16 for building a three-span iron bridge. F. J. O'Flaherty, County Surv. and Bridge Comr., Kansas City, Mo.

NEBRASKA CITY, NEB.—Bids are asked until Dec. 10 for rebuilding a 100-ft. iron bridge. F. E. Whyman, Chn. County Bd., Nebraska City.

HOUSTON, TEX.—The contract for an iron drawbridge over Buffalo Bayou has been awarded to the New Columbus Bridge Co., at $38,764. The bids were published in our issue of Nov. 21. G. M. Le Noue, Cy. Engr.

DENVER, COLO.—The board of public works has decided to advertise for bids for the purchase of $95,000 of bonds for completing the 14th St. viaduct.

STOCKTON, CAL.—The San Joaquin Valley Ry. Co. has awarded the contract for constructing the foundations for two bridges in Stanislaus county to the San Francisco Bridge Co., San Francisco.

BRANDON, MAN.—It is stated that the following bids were recently received for constructing a highway bridge at 18th St.; H. G. Dickson, Cy. Engr.:

| | |
|---|---|
| T. A. Cramer, Carmen, Man. | $1,500 |
| John Hanbury, Brandon | 1,733 |
| R. McKenzie, Brandon | 1,952 |
| Joseph Curtis, Brandon | 2,000 |
| A. G. Akins, Winnipeg, Man. | 2,377 |
| James Drake, Winnipeg | 2,489 |
| Rourke & Cass, Winnipeg | 2,492 |
| Alex. Foster, Brandon | 2,496 |
| Lissaman & Lang, Brandon | 2,755 |

MONTREAL, QUE.—Press reports state as follows: The Montreal & South Shore Highway Bridge & Electric Co. has been formed to construct a highway bridge from this city to St. Lambert, Que. It is intended to connect Montreal, by way of the proposed bridge, with Longueuill and La Prairie by electric railways. The bridge, as designed, will have ample roadways for wheeled vehicles, double track for electric cars, footpaths and special accommodation for bicyclists. The bridge, estimated to cost $1,250,000, is to have 24 spans of 240 ft. each and one of 350 ft.

## BUILDINGS.

BOSTON, MASS.—Bids are asked until Dec. 10 for constructing two dormitories for the parental school at West Roxbury. Archs., Stickney & Austin, 50 Bloomfield St., Boston; Alfred B. Heath, Institutions Comr., 14 Beacon St., Boston.

BROOKLYN, N. Y.—Benjamin Dreisler, 1017 Rogers Ave., Brooklyn, has prepared plans for a two-story brick car house, 125 × 100 ft., to cost $50,000, at Manhattan Ave. and Box St., for the Brooklyn Heights R. R. Co.

BUFFALO, N. Y.—Bids are asked until Dec. 23 for basement columns, first floor framing, etc., for U. S. public building in this city, as stated in our advertising columns. Wm. Martin Aiken, Supervising Architect, Washington, D. C.

BUFFALO, N. Y.—Richard A. Waite, Arch., German Insurance Bldg., Buffalo, has been authorized by the city hall trustees to prepare preliminary plans for putting an additional story on the city hall.—Frederic W. Brown, Chapin Block, Buffalo, has prepared plans for a $225,000 convention hall for the national conventions next year, which it is hoped to bring to this city.

NIAGARA FALLS, N. Y.—It is stated that contracts will soon be let for constructing about 50 new houses on 23d St., to cost about $300,000, for Mr. Crabb, of Cleveland, O. Geo. Haynes, of Niagara Falls, is interested.

NEW YORK, N. Y.—Renwick, Aspinwall & Co., 367 Fifth Ave., New York, have prepared plans for a 14-story office building for the Cass Realty Co. at 43 and 45 West 32d St., to cost $500,000.—Albert Wagner, 67 University Place, New York, has prepared plans for an eight-story building, 100 × 75 ft., at 260 to 266 West 36th St., for Ludwig Bauman, to cost $175,000.—Richard Berger, 309 Broadway, has prepared plans for a 13-story brick factory building for the Central Real Estate Association, 106 Broadway, at 228 to 232 Fourth Ave., to cost $500,000.—Geo. Edward Harding & Gooch have prepared plans for a 21-story stone office building at Broad and New Sts., to cost $1,000,000, for the Commercial Cable Co.—J. Houser, 1441 Third Ave., has prepared plans for three brick apartment houses, to cost about $200,000 each.

HOBOKEN, N. J.—Bids are asked until Dec. 23 for constructing a library building. Arch., A. Beyer, Second National Bank, Hoboken; Thos. F. Hatfield, Librarian.

PHILADELPHIA, PA.—W. G. Button has prepared plans for a $100,000 casino, 200 × 120 ft., for the Union Traction Co. Address Chas. McCaul, 9 North 11th St., Philadelphia.—Bids are asked until Dec. 12 for constructing foundations for engine and boilers for the repair shop, steam hammers and extending smokestack 14 ft. Abraham M. Beitler, Dir. Pub. Safety.

PHILADELPHIA, PA.—James Bite and Henry Bacon, of New York, N. Y., have been awarded the first prize of $6,000 for the best plans for the new art building in Fairmount Park, as advertised in Engineering News. The other prizes were as follows: Second, Lord, Hewlett & Hull, of New York, $3,000; third, Marcel Perouse, Paris, France, $2,000; fourth, Howard & Caldwell, New York, $1,000. There were 67 plans received for the building, which will be 612 × 275 ft., and 56 ft. high. Daniel H. Burnham, of Chicago; Stanford White and Prof. William R. Nave, of New York, and John G. Johnson and Joseph M. Wilson, of Philadelphia, were appointed by the park commission to report on the plans.

ALEXANDRIA, VA.—Plans have been prepared for a $250,000 round house, etc., for the Southern Ry. Ch. Engr., C. H. Hudson, 1300 Pennsylvania Ave., Washington.

RICHMOND, VA.—It is reported that plans have been prepared for the new Chesapeake & Ohio Ry. passenger station in Richmond. The station and other improvements will cost about $2,000,000. Gen. Man., Geo. W. Stevens, Richmond.

CHARLOTTE, N. C.—E. Shealy, of Spartanburg, S. C., has bought the plant of the Lazelle Reed & Harness Co. for the manufacture of reeds, harness and other cotton mill supplies at this place. It is his intention to materially increase the size of the plant, and he will probably erect new buildings for the purpose.—The Seaboard Air Line will build a passenger depot at this place at once. The plans for the building, which will be a two-story one, and include offices for local officers, telegraph office, engineers' dormitory, etc., have been completed. The company will receive bids for the work soon. Plans and specifications will be furnished by D. A. Tompkins, Charlotte, N. C., or Capt. K. S. Finch, agent of the company, at Charlotte.

DURHAM, N. C.—Thomas H. Martin will erect a block of brick and stone buildings at this place for business houses.

STATESVILLE, N. C.—Dr. H. F. Long will establish a sanitarium at this place, and will soon let the contract for a brick and stone building to be erected near the city for that purpose.

LOUISVILLE, KY.—Subscriptions are being taken for money to aid in the construction of a Y. M. C. A. hall, to cost about $150,000. Owen Gathright, Chn. Bldg. Com., Louisville.

CINCINNATI, O.—It is stated that the New England Investment Co., of Boston, Mass., has secured a lease of the property at Fourth and Walnut Sts. from the Wm. Gibson estate, on which it is proposed to erect a 16-story office building, 100 × 100 ft.

DETROIT, MICH.—G. T. Abney & Co., 56 Grand River Ave., Detroit, it is reported, will erect a 12-story brick and stone hotel, 71 × 60 ft., to cost $200,000.

DETROIT, MICH.—Bids are asked until Dec. 6 for the erection of a county jail building, 213 × 105¼ ft., at Clinton, Beaubien and Raynor Sts. Henry M. Reynolds, Secy.; W. H. Hoyt, Chn. Bd. County Auditors and Supervisors Com., Detroit.

CHICAGO, ILL.—M. H. Vail, Unity Bldg., Chicago, has completed plans for a $300,000 apartment house.—J. E. O. Prednore, Champlain Bldg., Chicago, has prepared plans for a $200,000 apartment house, for W. A. Scott.

DIXON, ILL.—The county board, it is reported, will meet Dec. 9 to decide on the question of constructing a new court house. J. H. Thompson, County Clk.

MILWAUKEE, WIS.—The following are some of the contracts already awarded for the construction of the new museum and library building, to cost $400,000: Structural ironwork, Wisconsin Bridge & Iron Co., Milwaukee, $40,310; carpenter work, Peter Cos & Co., $30,750; ornamental iron contract, J. G. Wagner, $11,000.

ORANGE CITY, IA.—Bids are asked until Dec. 11 for constructing a steel cage, 12 × 10 × 7½ ft., for the Sioux county jail. H. J. Lenderink, County Audr.

OLATHE, KAN.—It is reported that Johnson county voted Nov. 30 on the question of issuing $80,000 in bonds for a new court house.

ST. LOUIS, MO.—Eames & Young, 318 North Eighth St., St. Louis, have prepared plans for a $160,000 bank building for the Mississippi Valley Trust Co., 303 North Fourth St., St. Louis.

HOUSTON, TEX.—Bids are asked until Dec. 18 for the purchase of $100,000 of 5% bonds, $25,000 of which are for a jail, $39,000 for bridges, and $36,000 for refunding. John T. Browne, Mayor.

VICTORIA, TEX.—Bids are asked by J. J. Welder, Victoria, until Dec. 16 for constructing a brick and stone residence, and also for plumbing and electric light wiring. Archs., McAadoo & Wooley, San Antonio, Tex.

OMAHA, NEB.—Plans have been prepared for a union passenger station, about 620 ft. long, to cost $2,000,000, for the Omaha Bridge & Terminal Co. Archs., Fisher & Lawrie, Omaha. John R. Webster, of Omaha, is interested.

OLYMPIA, WASH.—We are informed that the following bids were received Nov. 19 for constructing a new state capitol building; Arch., Ernest Flagg, 54 Broad St., New York, N. Y.; Edmund Rice, Secy. Capitol Comrs.; (1) being original bid; (2) first alternative, add to original bid; (3) second alternative, add to original; (4) third alternative, add to original; (5) fourth alternative, deduct from original bid:

| | 1. | 2. | 3. | 4. | 5. |
|---|---|---|---|---|---|
| [1]D. W. Starrett | $973,158 | $39,400 | $6,681 | $17,000 | $89,000 |
| [2]John Keenen | 944,000 | ..... | ..... | ..... | ..... |
| [3]Oskar Huber | 986,545 | 26,540 | 12,675 | 11,340 | 121,200 |
| [2]F. D. Heustis and A. E. Barrett | 946,000 | 21,500 | 7,500 | 4,500 | 69,750 |

[1] Port Townsend, Wash. [2] Spokane, Wash. [3] Tacoma, Wash.

SAN FRANCISCO, CAL.—The Kehrlein Opera House Co. has been incorporated with a capital stock of $150,000 by Emil Kehrlein, H. B. Russ and Thomas F. Barry.

## WATER-WORKS.

YARMOUTH, ME.—At a recent town meeting it is reported that it was voted to issue $40,000 in bonds for water-works and sewers.

WATERBURY, VT.—The meeting to consider the water question has been postponed from Nov. 28, as advertised in Engineering News, to Dec. 9. C. D. Robinson, Secy. Com.

HATFIELD, MASS.—Bids are asked until Dec. 27 for the pipe and special castings for the proposed works, as stated in our advertising columns. E. C. & E. E. Davis, Engrs., Northampton.

LEE, MASS.—The Stockbridge Water Co. is reported to have petitioned for authority to extend its mains in this place.

MILLER'S FALLS, MASS.—John Lynch and S. H. Amidon are members of a committee appointed to consider plans for a water supply.

NEWTON, MASS.—The water board has been authorized to lay about 2,500 ft. of extensions, at an estimated cost of $3,358.

WINCHENDON, MASS.—The contract for building a reservoir, as advertised in Engineering News, has been awarded to Thos. Hennessey, of Jefferson, Mass. The prices are withheld from publication. W. C. Corey, Secy. Comrs.

DANBURY, CONN.—Plans are being considered for utilizing the Boggs Pond water supply, at an estimated cost of $145,000.—It is stated that the adoption of the meter system would cost $25,000.

GOSHEN, N. Y.—The efforts of the trustees to secure a better water supply are reported as only partially successful, and there is talk of laying a pipe to Wawayanda Lake, in the Warwick Mountains, 15 miles distant.

HOMER, N. Y.—The contract with the water company expired some time ago, and a meeting of the citizens has been held to discuss the advisability of purchasing the plant.

LIVONIA, N. Y.—It is stated that a meeting was held last week to consider the advisability of constructing works.

ASBURY PARK, N. J.—The council has awarded the contract for a 1,000,000-gallon pump to Henry R. Worthington.

ATLANTIC CITY, N. J.—Bids are asked until Dec. 16 for hauling and laying about 1,450 gross tons of 16 to 4-in. pipe, including trenching, furnishing cast iron pipe, and furnishing 254 valves and 100 hydrants, as stated in our advertising columns. Geo. T. Prince, Engr. and Supt., writes us that $175,000 in bonds will be issued at once and about 12 miles of distribution mains will be laid to complete the system recently purchased by the city. Bids for 24 and 30-in. force mains will be asked after the above contracts have been awarded.

CAMDEN, N. J.—The council has voted to contract with the Wagner Water Supply Co., of Dayton, O., for a new water supply of 20,000,000 gallons a day from artesian wells, at a cost of $558,000.

CHESTER, PA.—The Linwood Water Co., noted Nov. 21, was incorporated Dec. 2, with a capital stock of $10,000, commencing with $1,000. Treas., Walter Wood, 1620 Locust St., Philadelphia.

FREELAND, PA.—The Freeland Water Co. is reported about to increase the size of its well to 12 ins., purchase a $3,000 pump, and in the spring enlarge the reservoir.

HAVERFORD, PA.—Press reports state that this place will soon have a $12,000 water-works plant.

LEBANON, PA.—In regard to our item last week, a correspondent writes us that Geo. W. Hayes, Cy. Engr.,

who has spent some time in making preliminary surveys for a large storage reservoir northwest of the city to be used in connection with the South Mountain watershed, has made a preliminary report to the water commissioners. He has made the preliminary surveys for two reservoirs. The larger would contain 120,500,000 gallons, and the smaller 77,000,000 gallons.

LEWISTOWN, PA.—It is reported that Engineer Corson, of Altoona, has completed surveys and estimates for a 6,000,000-gallon reservoir, from which water will be piped about five miles to this place.

McKEESPORT, PA.—The common council has authorized a loan of $20,000 for a water supply from artesian wells. It is thought that 15 wells would be required. The select council has not yet approved the plan, and is said to be in favor of a supply from the Monongahela River, at Glassport.

NEW CASTLE, PA.—The council has voted to refuse to pay any more bills for water until the company furnishes a filtered supply.

POTTSVILLE, PA.—The Sharp Mountain Water Co. is reported to have been incorporated, with a capital stock of $7,500, by Wm. Lathrop and F. M. Chase, of Wilkes Barre; A. B. Cochran, and others, of Pottsville.

SHAMOKIN, PA.—The Deep Creek Water Co. is reported to have been incorporated, with a capital stock of $20,000, to supply water in Mount Carmel township. S. P. Wolverton, of Sunbury; W. C. McConnell and C. O. McWilliams, of Shamokin, and others.

SPRINGTOWN, PA.—The Springtown Water Co. was incorporated Dec. 2, with a capital stock of $1,400; Treas., Jacob B. Pearson.

MARIETTA, GA.—The Marietta Paper Mfg. Co. is reported to have awarded the contract for constructing works to Felton & Sullivan, of Cuthbert, Ga.

LAFAYETTE, LA.—Robert P. Zell, 16 Goodcheaux Bldg., New Orleans, has been engaged to make plans and estimates for water-works and an electric light plant. T. M. Biossat, Chn. Com.

BLUFFTON, O.—P. H. Porter & Co., Louisville, Ky., have been engaged to prepare plans and specifications for works.

CLEVELAND, O.—The director of public works has been directed to advertise for bids for a 9-ft. steel or brick intake tunnel, to be extended at least four miles from shore, and for an 8½ or 9-ft. extension of the present intake tunnel; also for a supply of pipe, valves, etc., for use during 1896.

GREENWICH, O.—A Cleveland engineer is reported to have been engaged to make preliminary surveys for works, and an electric light plant, and there is talk of an election to vote on an issue of bonds for the construction.

INDIANAPOLIS, IND.—We are informed that the water company has had surveys made to show the practicability of turning Fall Creek into the river above the city, and reclaiming ground. It is found to be possible on several routes, but quite expensive, the cost ranging from $100,000 up for various lines. The board of public works is considering the matter.

LA PORTE, IND.—The water commissioners have contracted with the Nordberg Mfg. Co., of Milwaukee, for a new pump, to cost $11,125.

LEAVENWORTH, IND.—W. N. Morrill, Engr., of New Albany, was in the city last week consulting with the trustees in regard to proposed works at this place. It is reported that bids will soon be asked for the construction.

CHARLOTTE, MICH.—At an election Nov. 25 the citizens voted to issue $12,000 in bonds for a new pump and other improvements.

TRENTON, MICH.—The citizens have voted, 187 to 37, to issue $10,000 in bonds for works.

WAYNE, MICH.—The special election resulted, 173 to 53, in favor of issuing $15,000 in bonds for works. The bonds will be issued at once, and the construction commenced as soon as possible. A stand-pipe will be required. Humphrey & Carr, Engrs., Detroit.

CHICAGO, ILL.—Bids are asked until Dec. 12 for laying water-service pipes in eight streets. W. D. Kent, Comr. Pub. Wks.

GALESBURG, ILL.—H. W. Carter, of St. Louis, has been awarded a contract for an artesian well, as noted under Contract Prices.

SPARTA, ILL.—A committee has been appointed to consider plans for works.

SPRINGFIELD, ILL.—Efforts are being made by residents of West Springfield to secure an independent system for that village.

UPPER ALTON, ILL.—The Upper Alton Water-Works Co. has been incorporated, with a capital stock of $2,500, by Geo. C. Morgan, A. M. Morgan and Henry A. Gardner, of Chicago.

SUPERIOR, WIS.—The Superior Light & Water Co. has improvements in view which will guarantee a better water supply, according to local papers; Secy., W. H. Winslow; Gen. Man., A. A. Cross.

LOHRVILLE, IA.—The citizens are reported as agitating the question of new water-works.

RICEVILLE, IA.—Press reports state that there is talk of constructing works at this place.

SIOUX CITY, IA.—Hanlon & Knepper have been awarded a contract for making extensions in several streets, at $6,947. The Novelty Plumbing & Engineering Works bid $7,287, and James Scollard & Son, $7,535.

MINNEAPOLIS, MINN.—The city engineer is reported as corresponding with filter companies, with a view to having model plants constructed for inspection this winter.

LEBANON, MO.—The property of the Lebanon Light & Water Co., including the street railway, and representing an investment of $325,000, has been purchased by Edmon E. Crebs, of Fairfield, Mo., as trustee.

FORT SCOTT, KAN.—The receiver of the Fort Scott Water Co. has been authorized to issue $30,000 of receiver's certificates for improving the plant, according to press reports.

GALVESTON, TEX.—Bids will soon be asked according to reports, for three to four miles of 10 to 6-in. extensions estimated to cost $28,000. R. H. Peek, Supt.

TROY, TEX.—A water supply has been secured at a depth of 1,500 ft.

COLORADO SPRINGS, COLO.—Bids are asked until Dec. 23 for constructing about 6,300 ft. of tunnel, as stated in our advertising columns (postponement of date from Dec. 9). H. I. Reid, Cy. Engr.; Chas. E. Smith, Cy. Clk.

CASPER, WYO.—The council has appropriated $3,000 to continue work on the new water-works. Lee Culver, Cy. Clk.

MILES CITY, MONT.—S. Gordon, Cy. Clk., writes us that the bonds recently voted were to purchase the existing works and electric light plant.

ROSSLAND, B. C.—Press reports state that the construction of works will be commenced within a few days. The bids for the work were opened some time ago.

OTTAWA, ONT.—The council is reported as considering plans for extensions estimated to cost $150,000.

## IRRIGATION.

ANTONITO, COLO.—Bids are asked until Dec. 16 for constructing an artesian well for irrigation purposes. H. A. Sumner, State Engr., Denver.—The governor is considering the question of resuming the construction of state canal No. 1, estimated to cost about $1,000,000, to irrigate the land between Canyon City and Pueblo.

EAGLE PASS, TEX.—It is reported that arrangements are being made by P. W. Thomson, of the Eagle Pass Irrigation & Water-Works Co., for resuming the construction of the canal, 25 miles long, from the Rio Grande River at a point about 30 miles above this place, estimated to cost about $1,000,000.

SALT LAKE CITY, UTAH.—Arrangements are completed for constructing two irrigation reservoirs in Carbor and Sanpete to utilize the waters of the Price River. The first will be in the Upper Gooseberry valley, and the second in the Lower Gooseberry valley. Surveys are now being made, and work will probably be begun this winter. E. M. Le Probon and W. F. Shelton, of Price, Utah, and Henry M. Ryan, Joseph H. Paris and Judge L. P. Boyle, of Chicago, Ill., are interested.

NEW COMPANIES.—East Fork Irrigation Co., Hood River, Ore.; $8,000; Levi Monroe, L. D. Boyed, J. L. Dimmick, Virgil Winchell.

Lost River Irrigating Ditch Co., Bonanza, Ore.; $5,000; B. A. Godfrey, Geo. McDonald, A. Castel.

Squaw Creek Irrigation Co., Prineville, Ore.; $2,000; E. T. Slayton, T. J. Fryrear, W. F. Fryrear, J. R. Fryrear.

Mount Hood Water Supply Co., Hood River, Ore.; $900; to appropriate water from the east fork of Hood River for rental, irrigation and domestic purposes; W. S. Gribble, Robert Leasure, James L. Langille.

Valley Improvement Co., Hood River, Ore.; $20,000; to take water from the stream of that name for all purposes; C. A. Bell, L. E. Morse, J. E. Hanna, J. H. Ferguson, H. F. Davidson, P. A. Snyder, C. M. Wolfard.

## SEWERAGE.

YARMOUTH, ME.—It is reported that bonds have been voted for sewers.

ARLINGTON, MASS.—We are informed that bids will be asked in a few days for sewer pipe for a system of 18 to 8-in. pipe sewers, nine miles long, estimated to cost $100,000. Bids for the construction will probably be received in February. The average cut will be 12 ft. Another correspondent writes us that on Nov. 14 it was decided to issue $100,000 in 4% bonds to begin the work. It is estimated that this, together with the sewer assessments, will complete the system, which will consist of 141,500 ft. of 18 to 6-in. pipe sewers. The outlets will discharge into the Metropolitan sewer at the boundary line of the township. Engr., Geo. A. Kimball, Exchange Bldg., 53 State St., Boston.

BELMONT, MASS.—W. L. Chenery, Town Clk., writes us that E. A. W. Hammatt, 29 Pemberton Square, Boston, is making surveys and estimates for a system.

LYNN, MASS.—The aldermen are considering the purchase of a Shone ejector, at an estimated cost of $8,000.

MELROSE, MASS.—The legislature is to be petitioned by the sewer commission for authority to issue $50,000 in bonds for extending the system. L. F. Hinckley is interested.

WAKEFIELD, MASS.—The following committee has been appointed to consider the advisability of constructing a sewer system: Lewis Hawes, Chn.; Michael Low, Secy.; Wm. H. McCauseland, and E. A. Carlisle.

WEBSTER, MASS.—W. S. Johnson, Asst. State Engr., has approved the plans for a new system prepared by L. A. Taylor, 21 Lancaster St., Worcester. The question is to be voted upon at the annual town meeting in April.

PAWTUCKET, R. I.—The commission appointed several months ago to secure plans, estimates, etc., for a sewer system for Valley Falls, Lonsdale, Ashton and other cities in the valley has not yet completed its work. Chn., W. H. Tobey, Pawtucket; Anthony I. Earle and John M. Ryan compose the commission.

BROOKLYN, N. Y.—Bids are asked until Dec. 10 for constructing a sewer. A. T. White, Comr. Cy. Wks.—The committee appointed to consider the question of improving Newtown Creek is preparing a report, in which it will recommend the construction of new sewers in the district around the creek. Chn., Geo. W. Brush, Brooklyn.

FAR ROCKAWAY, N. Y.—The taxpayers voted again, Nov. 26, to construct a sewer system. The system will include disposal works and pumping stations. The work of constructing the sewers was recently advertised in Engineering News, and the bids were published in our issue of Oct. 17, but the election was found to be illegal. Engr., Alexander Potter, 137 Broadway, New York.

FULTON, N. Y.—The question of constructing a sewer system is again being considered. This question was voted upon some time ago, but was defeated.

GENEVA, N. Y.—It is estimated that a sewer system for the village will cost $110,000, according to reports.

HAVERSTRAW, N. Y.—An election was recently held in this city to vote on the question of constructing a system, estimated to cost about $50,000. N. B. Bayley, Pres. Sewer Comrs.

NEW YORK, N. Y.—Bids are asked by the department of public works until Dec. 10 for constructing a sewer in Union Square West.

NEW YORK, N. Y.—Press reports state as follows: The Bronx River sewer committee, which was appointed to consider the advisability of constructing a trunk sewer, 20 miles long, that would parallel the Bronx River from White Plains to the East River, and to report the conclusions to the next legislature, met in the mayor's office a few days ago. The preliminary maps have been examined, and the commission has passed a resolution declaring that the project was advisable and practicable. It was decided to hold a series of public hearings on the subject during the first 10 days of January at Mount Vernon, White Plains, Yonkers, William's Bridge, and in the mayor's office, this city. After these hearings the report of the commission will be prepared and forwarded to Albany. The question of how this work, if authorized, is to be paid for, has not been settled, and a committee was appointed to report upon a financial plan. This committee is made up of Mayor Strong, of New York; Mayor Pence, of Yonkers; Mayor Lewis, of Mount Vernon; James Wood, of Mount Kisco, and Frank Carpenter, Chn. Bd. Supervisors Westchester County.

ROCHESTER, N. Y.—John Y. McClintock, Cy. Engr., writes us that the first ordinance has been passed for a sewer in Monroe Ave., from Oxford St. west, estimated to cost $16,000. The work will be paid for by local assessment.—The east side trunk sewer commission has directed the engineer to prepare plans for a storm overflow sewer to empty into the river at Clarissa St., to relieve Mount Hope.

SANDY HILL, N. Y.—It is stated that surveys for a system are about completed. Engr., John W. Burke, 45 Broadway, New York; Orville Griffin, Sandy Hill, is interested.

SYRACUSE, N. Y.—Bids are asked until Dec. 9 for constructing 24 to 12-in. pipe sewers in 15 streets. H. F. Stephens, Cy. Clk.—It is proposed to construct 24 to 12-in. pipe sewers in 10 streets at an estimated cost of about $26,000.

WAVERLY, N. Y.—Plans and specifications have been prepared for a sewer system and sewage disposal works. F. E. Hawkes, Village Clk.

WASHINGTON, D. C.—The following bids were recently received by the district commissioners for constructing brick sewers on private property between Brightwood Ave. and Piney Branch road: James McCandish, $3.97 per lin. ft.; manholes, $20 each. Barius Gaskins, $3.20; manholes, $15 each. John E. Lyons, $3.58; manholes, $25 each. E. G. Gummell, $3.98; manholes, $20 each. H. C. Nichols, $4.45; manholes, $18 each.

WILSON, N. C.—John R. Moore, Cy. Clk., writes us that at the election held Nov. 25 it was voted to issue $17,000 in bonds for sewers.

TAMPA, FLA.—The council is considering an ordinance authorizing the finance committee to issue $25,000 in bonds for making surveys and preparing plans for a sewer system and for paving, according to reports.

FRANKPORT, IND.—James A. Price, Cy. Clk., writes us that contracts will be let early in the spring for constructing one mile of 12 to 6-in. pipe sewers, average cut, 10 to 5 ft. A. J. Hammond, Cy. Engr.

GREENFIELD, IND.—Bids are asked until Dec. 18 for constructing 1,020 ft. of 10 and 8-in. pipe sewers, the work to include 30 Y-branches, 3 manholes and 1 lamphole. W. J. Cleary, Cy. Engr.

INDIANAPOLIS, IND.—M. G. Hornaday, Ch. Clk. Engrs. Dept., writes us that plans and details for the Pogue Run sewer, to cost about $700,000, will be presented to the board of public works about Jan. 15. The sewer will be of brick and 18,000 ft. long, as noted in our issue of last week. B. J. T. Jeup, Acting Cy. Engr.

VALPARAISO, IND.—Bids are asked until Dec. 13 for constructing 1,000 ft. of 8-in. pipe sewer. J. W. Holladay, Cy. Clk.

AUSTIN, ILL.—Dennis Cleary, 110 Locust St., Chicago, has been awarded the contract for constructing sections 1, 2 and 4 of the main sewer, estimated to cost $123,253. Nash & Dowdle, 159 La Salle St., Chicago, have been awarded the contract for section 3.

CHICAGO, ILL.—The street committee has recommended the passage of the ordinance authorizing the construction of the 83d St. sewer system, which will empty into the river. A pumping station will be erected at Western Ave. to raise the sewage 18 ft. The system will be 16 miles long, 12 to 3 ft. in diameter, and is estimated to cost about $1,295,000, as noted in our issue of Oct. 10. G. L. Clausen, Supt. of Sewers; Wm. D. Kent, Comr. Pub. Wks.

MILWAUKEE, WIS.—We are informed that preliminary plans have been prepared for a scheme for flushing out the Kinnickinnic River in this city. No appropriations have yet been made, but they probably will be in the spring. Geo. H. Benzenberg, Cy. Engr.

ST. CLOUD, MINN.—The council is to be petitioned to construct a sewer in the north side ravine.

SAN FRANCISCO, CAL.—The street superintendent has been authorized to spend $250,000 for improving the sewers and streets.

UKIAH, CAL.—It is reported that the city has voted to issue $25,000 in bonds for constructing a sewer system estimated to cost $40,000, the city having already $15,000 for the purpose.

## GARBAGE DISPOSAL.

BUFFALO, N. Y.—The aldermen have voted to award the contract for garbage collection for three years to John Johnson at $110,000.

SYRACUSE, N. Y.—Local papers state that the contract with the American Reduction Co. will probably be annulled, and that the Holthaus system may be adopted.

TRENTON, N. J.—The council received seven bids Nov. 26 for collecting and disposing of the garbage of the city for five years, including bids for reduction and crematory plants. The board of health presented a resolution favoring a crematory.

ALLEGHENY, PA.—Bids are asked until Dec. 16 for collecting and disposing of the garbage of the city for four years from May 1; contractor to have a plant or furnace for the burning of the garbage in each of the two sections into which the city is divided. John R. Murphy, Dir. Dept. Pub. Safety.

DAYTON, O.—Bids are asked until Jan. 2 for the construction of a garbage disposal plant to destroy all kinds of garbage and city refuse for a city of 110,000 population. C. A. Herbig, Cy. Comptroller.

DES MOINES, IA.—It is stated that a new crematory is badly needed to replace the one at the foot of Eighth St.

SHELDON, IA.—The local paper urges that steps be taken to dispose of garbage in a healthy manner, and suggests that it be burned.

SAN FRANCISCO, CAL.—The board of supervisors has passed an ordinance providing that bids be asked for the construction of a crematory to burn the garbage of the city.

## STREETS AND ROADS.

CAMBRIDGE, MASS.—Bids are asked until Dec. 11 for grading highways at the Hobbs Brook reservoir, in Lincoln and Lexington, Mass. The work will include about 339,000 cu. yds. of grading, surfacing, filling, etc., 1,600 lin. ft. of fencing. L. M. Hastings, Cy. Engr.

BROOKLYN, N. Y.—Bids are asked until Dec. 10 for Belgian block paving in Stewart St., and until Dec. 11 for flagging sidewalks in about 50 streets. Alfred T. White, Comr. Cy. Wks.

NIAGARA FALLS, N. Y.—W. Caryl Ely, of Niagara Falls, is interested in a projected boulevard between Buffalo and Niagara Falls.

SYRACUSE, N. Y.—Bids are asked until Dec. 9 for grading and macadamizing in a number of streets, and until Dec. 16 for asphalt, brick or sandstone block paving in two streets; check, $5,000. H. F. Stephens, Cy. Clk.

JERSEY CITY, N. J.—Bids are asked until Dec. 9 for improving Jackson Place, the work to include 7,500 cu. yds. earth excavation and filling, 500 cu. yds. rock excavation and 9,000 sq. ft. flagging. John C. Kaiser, Chn. St. Com.

BALTIMORE, MD.—The council is considering several ordinances for a large amount of repaving with granite blocks or asphalt. Janon Fisher, Cy. Comr.

JACKSONVILLE, FLA.—A. F. Harley, Cy. Engr., has submitted to the board of public works estimates for 24,000 sq. yds. of brick paving in two streets to cost about $41,000.

TAMPA, FLA.—The council proposes to issue $25,000 in bonds, for making surveys, plans, etc., for paving and sewers, according to reports.

WESTWOOD, O.—Bids are asked until Dec. 26 for the purchase of about 15,000 of 6% bonds for constructing cement sidewalks. Emory M. Garrison, Attorney, 40 Smith Bldg., Cincinnati; Robt. A. Armstrong, Village Clk.

EAST ST. LOUIS, ILL.—The council has rejected the bids for brick paving in Ninth St. and Illnois Ave., and has decided to readvertise. L. L. Harper,, Cy. Engr.

KANSAS CITY, MO.—The board of public works has recommended asphalt, brick and macadam paving in several streets. H. H. Filley, Cy. Engr.

KANSAS CITY, KAN.—The question of constructing a macadam driveway 30 miles long and 18 ft. wide to Olathe, Kan., at an estimated cost of $1,500 a mile is being discussed. P. McAnany and W. A. Mitchell, of Olathe, are interested. E. A. Ellis, Cy. Engr.

MINNEAPOLIS, MINN.—F. W. Cappelen, Cy. Engr., has submitted a list of 11 streets (135,247 sq. yds.) to be repaved with asphalt, cedar blocks or brick.

## MANUFACTURING PLANTS.

ENFIELD, N. H.—George Whitney, of this place, is said to be at the head of a movement to build a new mill at Enfield, for the manufacture of yarn, to be three stories, 112 × 56 ft.

MANCHESTER, N. H.—It is reported that J. M. Brown, of Sands & Brown, contemplates the erection of a plant for the manufacture of furniture.

SOUTH HADLEY FALLS, MASS.—The Carew Mfg. Co. is reported about to build a five-story extension, 25 × 75 ft., to the present mill. A 250-HP. boiler and a 300-HP. steam engine will be put in.

TAUNTON, MASS.—It is reported that Peter H. Corr is interested in the erection of a 40,000-spindle fancy goods cotton mill, to be erected at East Taunton, to cost $400,000. The plant will be run by steam power.

WORCESTER, MASS.—A press report states that Samuel E. Winslow has purchased the factory and land owned by Charles G. Reed, for the manufacture of wheels and wheel stock, and that the plant will be enlarged.

NEW HAVEN, CONN.—Press reports state that the Wilcox & Howe Co., of Shelton, has leased the foundries of the Belden Machine Co., and the Hoggson & Pettis Mfg. Co., of New Haven, and the Sperry Mfg. Co., of Ansonia. The company has just voted to expend $25,000 for new machinery, to be used in the Shelton factory.

CORTLAND, N. Y.—Cooper Bros. foundry and machine shop was recently destroyed by fire; reported loss, $40,000; insurance, $20,000.

KINGSTON, N. Y.—It is reported that a movement is on foot among capitalists of this city to form a stock company to erect an extensive factory building for the Peckham Motor, Truck & Wheel Co. It is said that $25,000 has been raised. The site proposed is that on which the old Columbia motor factory, owned by Hewett Boyce, formerly stood.

MEDINA, N. Y.—It is understood that plans are being made in Medina for the construction of a large bicycle manufactory. Lee W. Hopper, Frank Houseman, W. Wilmarth and Warren L. Hommodieu are interested. Work on the erection of buildings has been commenced.

NEW YORK, N. Y.—It is reported that the Central Real Estate Assoc., 309 Broadway, will erect a 13-story factory building at 19th St. and Fourth Ave., to cost $500,000.

PORT RICHMOND, S. I., N. Y.—The grain elevator controlled by the Quinlan & Travis Co. was recently burned; reported loss, $75,000.

PATERSON, N. J.—It is stated that McNab & Harlan will erect a new foundry near their present works.

ALTOONA, PA.—It is reported that a new wheel foundry, to make all the wheels needed on the Pennsylvania R. R. system, will be built by the company at this place next summer.

CLIFTON, PA.—Seymour Davis, of Philadelphia, is reported as preparing plans for a large bicycle factory to be built at Clifton, Delaware county, to be two stories, 40 × 100 ft., and furnished with steam power and heat, electric wiring, etc.

MEDIA, PA.—Morris C. Michener is reported as having purchased the ice business of Frank Tyler, and will shortly commence the erection of an artificial ice plant.

PHILADELPHIA, PA.—It is reported that Harrison Bros. & Co. are about to build on the Schuylkill River, between 34th and 35th Sts., an iron building for the manufacture of varnish. —Plans are being drawn by Wm. MacCollin, Arch., for a four-story brick factory for Horn & Brannan, on the site of the firm's electric and gas-fixture manufactory, which was recently destroyed by fire.—Steel & Co. are said to be preparing plans for a large factory, to cost about $30,000.

PITTSBURG, PA.—The Pennsylvania Lubricating Co. will erect a one-story ironclad factory in the rear of 34th St., 15th ward, according to reports.

READING, PA.—A report states that a syndicate of capitalists, represented by F. R. Phillips, of Philadelphia, will soon establish a tin plate manufactory in this city.

ROYERSFORD, PA.—The Royersford Machine Co. is erecting a foundry for making heavy castings. It is to be 42 × 65 ft., and of brick.

SOUTH CHESTER, PA.—McCann & Co., of Philadelphia, Pa., manufacturers of patent pipe covering, are reported as negotiating for the purchase of a mill in this city.

DANVILLE, VA.—At a meeting of the board of directors of the Riverside Cotton Mills Co. it was decided to erect another mill on the north side of the river.

RALEIGH, N. C.—John C. Drewry, Wiley V. Clifton, and associates, will build a small cotton mill near this city next spring.

INMAN, S. C.—A company is being organized to build a cotton mill at this place, and $25,000 has been subscribed towards the enterprise.

NEWBERRY, S. C.—There is a plan under discussion to build another cotton mill at Newberry.

OGLETHORPE, GA.—The old Alpha mills, of Oglethorpe county, have been purchased by N. D. Arnold, who will equip the buildings by putting in a cotton mill plant, to be operated by water power.

BIRMINGHAM, ALA.—The East Birmingham Smelting Works has been burned; reported loss, $20,000; insurance, $10,000.

LAFAYETTE, LA.—Press report states that J. W. Brown, Jr., of Camden, Ark., will soon commence the erection of an ice factory of 10 tons per day capacity.

LENOIR CITY, TENN.—A cotton mill is to be erected in this city at once. The capital stock of the company is $100,000, all of which has been paid in, according to the reports.

STEUBENVILLE, O.—It is stated that a plant will be established here for the manufacture of street cars, and that $50,000 will be put into buildings and machinery. Aultman & Lovejoy, of Chicago, are interested.

YOUNGSTOWN, O.—Press reports state that within the next 90 days a fully-equipped plant here will be turning out tin plate. Those interested in the new enterprise are experienced tin-plate workers, and the capital will be furnished largely by local capitalists. Roger Evans, a prominent member of the Amalgamated association, and the New York State Electric Supply Co., are interested.

MICHIGAN CITY, IND.—It is understood that the street railway company will erect a building to contain engines, boilers and dynamos. F. H. Root, Supt.

ADRIAN, MICH.—The Bond Steel Fence Post Co. will erect a large plant near the Wabash depot, according to press reports.

DELRAY, MICH.—It is reported that foreign capitalists propose establishing an extensive glass manufacturing plant in this place. Julius Mond, of the Brummer-Mond Alkali Co., of England, and Louis Lambert, of Charleroi, Belgium, are interested. Col. A. L. Conger, of Akron, O., is considering the proposal.

PONTIAC, MICH.—The Armstrong Spring & Axle Co., of Flint, is said to be seeking a site in this city, with a view of removing its plant.

CHICAGO, ILL.—It is stated that the Northwestern Fertilizer Co., 45th St. and Center Ave., will erect a two-story brick and stone fertilizer factory, 162 × 113 ft; cost, $16,000.

EAU CLAIRE, WIS.—O'Keefe & Orbison, of Appleton, Wis., have a contract to build an additional pulp mill for the Dells Pulp & Paper Co., of this city, to cost about $50,000. This will make the entire plant worth over $300,000.

SAUK RAPIDS, MINN.—John Strange, Pres. John Strange Paper Co., of Menasha, Wis., has decided to build his new paper mill at this place, according to reports; estimated cost, $250,000.

PITTSBURG, KAN.—It is stated that S. W. Campbell and S. W. Coglizer, composing the firm of Campbell & Co., will locate a factory in this city, and expect to be ready for operation by Feb. 1.

KANSAS CITY, MO.—It is reported that Theodore F. Bates, of Worcester, Mass., Pres. Kansas City & Atlantic Ry., is at the head of the Terminal Improvement Co., organized, with a capital stock of $175,000, to build warehouses, grain elevators, wharves, etc., in Kansas City. Shareholders, Arthur C. Paine, Portland, Me.; H. A. Edgecomb, Wellesley, Mass., and Samuel C. Moore, K. M. De Weese, J. M. Fox and others, of Kansas City.

ST. LOUIS, MO.—The main building of the St. Louis Shovel Co.'s plant was recently destroyed by fire; reported loss, between $80,000 and $100,000; covered by insurance.

QUEBEC, QUE.—Plans are now being prepared for car shops which, it is stated, that the Great Northern R. R. Co. proposes erecting in this city.

## MISCELLANEOUS CONTRACTS AND SUPPLIES.

DREDGING.—Ottawa, Ont.—Bids are asked until Jan. 7 for dredging Collingwood Harbor. E. F. E. Roy, Secy. Dept. Pub. Wks.

FIRE HOSE.—New York, N. Y.—Bids are asked by the fire department until Dec. 11 for 9,000 ft. of 3 to 1½-in. rubber-lined fire hose, with couplings.

LAMPS.—New York, N. Y.—Bids are asked until Dec. 27 for supplying 250 pendent and 500 bracket lamps. Gen. Jas. M. Moore, A. Q. M., Army Bldg.

DREDGING.—Buffalo, N. Y.—The council has voted to order Peck Slip dredged to a depth of 20 ft., with a 140-ft. channel. Mark S. Hubbell, Cy. Clk.

DERRICKS.—Bowling Green, O.—The Standard Oil Co. is reported to have had over 1,000 derricks blown down in this vicinity by a recent storm, the loss reaching $150,000.

REMOVAL OF SNOW.—New York, N. Y.—Bids are asked until Dec. 16 for the removal of snow from the streets of the city until May 1. Geo. E. Waring, Jr., Comr. St. Cleaning.

REMOVAL OF WRECK.—Boston, Mass.—Bids are asked until Dec. 26 for the removal of the wreck of the schooner "Lillie," in Boston Harbor. Lieut.-Col. S. M. Mansfield, U. S. Engrs.

ROAD MACHINES.—Owensboro, Ky.—It is reported that Judge Karn will call a meeting of the fiscal court for Dec. 11, to consider bids for furnishing new road machines to be bought by the county.

LEVEE WORK.—New Orleans, La.—The bids for about 108,000 cu. yds. of work in the Lafourchee levee district were recently rejected, as noted under Contract Prices, and the work will be readvertised.

COFFERDAM.—Syracuse, N. Y.—Bids are asked until Dec. 16 for furnishing materials and constructing a cofferdam across the Erie Canal at its intersection with West Genesee St. H. F. Stephens, Cy. Clk.

BREAKWATER.—Duluth, Minn.—Bids are asked until Dec. 26 for building 200 ft. of timber crib and superstructure for west breakwater at Agate Bay (Two Harbors), Minn. Maj. Clinton B. Sears, U. S. Engrs.

NAVAL SUPPLIES.—New York, N. Y.—Bids are asked until Dec. 10 for sundry supplies for the New York navy yard, including air pumps, steam pump, etc. Edwin Stewart, Paymaster-General, Washington, D. C.

GASOLINE LIGHTING.—Omaha, Neb.—Bids are asked until Dec. 10, according to reports, for lighting the streets of the suburbs with 16-c. p. gasoline lamps for two years from Jan. 29. Theo. Olsen, Cy. Comptroller.

DAM.—Montreal, Que.—Press reports state that the work of utilizing the water power at Lachine Rapids is progressing rapidly, and that as soon as the excavations in the reclaimed area are finished another dam, similar to the one now completed, will be built farther up the river. Then the permanent dam will be built and the temporary one removed.

LOCKS.—Lockport, N. Y.—Campbell W. Adams, State Engr., is reported to have engaged F. M. Sylvester, of the Buffalo Engineering Co., of Buffalo, to prepare plans and specifications for the proposed two large steel lift locks to be built in the Erie Canal at this place. The locks will probably cost about $500,000, and it is expected that the plans will be completed by March 1.

PARK.—Newark, N. J.—A press report states that the Essex county park board has purchased about 200 acres of land at Eagle Rock, on the Orange Mountains, from Alex. T. Compton, including the resort on the rock and the approaches thereto and adjacent property on each side. Possession will be secured early in February next, and the work of laying out a public park at this place will then be commenced.

DOCK IMPROVEMENTS.—Erie, Pa.—A press report from this city states that the Erie & Pittsburg Dock Co. has decided to rebuild its ore wharves at this port this winter. Nine new hoisting machines will be put in and a 20-ft. channel will be dredged all around the docks. New coal chutes will be built also. The Pennsylvania R. R. will lay double tracks from the docks to the junction. The improvement will cost in all about $100,000.

SMOKE-CONSUMING DEVICE.—Cleveland, O.—The city council is considering the bids received some time ago for a smoke-consuming and stoker device for the new boiler house at the water-works, the bids being as follows:

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| American Stoker Co., Dayton, O. | $4,950 |
| American Smokeless Furnace Co., Cleveland, O. | 4,720 |
| Brightman Stoker Co., Cleveland, O. | 5,280 |
| Hawley Down Draft Furnace Co., Chicago, Ill. | 5,450 |
| Ohlstrom Co. | 8,960 |

BATTLESHIPS.—Washington, D. C.—The following bids were received Nov. 30 for constructing battleships Nos. 5 and 6, authorized at the last session of congress, and estimated to cost $8,000,000:

Newport News Shipbuilding & Drydock Co., of Newport News, Va.—For constructing one vessel on the plans prepared by the navy department, $2,350,000; for both, $2,250,000 each.

Union Iron Works, of San Francisco, Cal.—Navy department plans, for one, $2,740,000; for both, $2,640,000 each. On plans prepared by the bidders, for one, $2,-650,000; for both, $2,640,000 each.

Wm. Cramp & Sons, of Philadelphia, Pa.—Navy department plans, for one, $2,820,000; for both, $2,750,000 each. On plans prepared by the bidders, for one, $2,500,000; for both, $2,450,000 each. Also a third proposition to build three battleships for $8,000,000, including hull and armor for two of them; two vessels for $3,850,000 each, including hull, armor and gun protection; one vessel for $2,500,000, or both for $2,450,000 each.

### CONTRACT PRICES.

MACADAMIZING.—Woodbury, N. J.—The contract for building six miles of stone road, as advertised in Engineering News, has been awarded to B. M. & J. F. Shanley, of Philadelphia, at 87 cts. a sq. yd. for 10 ins. telford and 83 cts. for 10 ins. macadam.

ASPHALT PAVING.—Kansas City, Mo.—The contract for paving Harrison St., between 12th and 16th Sts., with asphalt has been awarded to the Barber Asphalt Paving Co., at $2.50 a sq. yd.; total, $13,710. H. H. Filley, Cy. Engr.

LEVEE WORK.—New Orleans, La.—The contract for 15,000 cu. yds. of enlargement on the Starlight levee, in the Lafourchee district, has been awarded to James N. Sullivan, of Sellers, La., at 12.68 cts. a cu. yd. The bids for 51,000 cu. yds. of work on the Fairfield levee and 56,500 cu. yds. on the Columbia Garden levee were rejected, and the work will be readvertised.

ARTESIAN WELL.—Galesburg, Ill.—H. W. Carter, of St. Louis, has been awarded the contract for sinking an artesian well at $2.85 per ft. for furnishing all materials and sinking and casing a 7¾-in. well. The bid for a 6¾-in. well was $2.75. The well will probably cost a little less than $4,000.

ASPHALT PAVING.—Denver, Colo.—The following bids were received Nov. 23 for paving 15th St. with asphalt, the specifications requiring 6 ins. of concrete foundation and 3½ ins. of asphalt wearing surface, or 1 in. more than usual, on account of the heavy traffic on this street: Colorado Paving Co., which uses the Barber Asphalt Paving Co.'s Trinidad Lake asphalt, $2.89 a sq. yd. for paving, 89 cts. a lin. ft. for 6×20-in. curbing, and 79 cts. for 6×16-in. curbing; total, $52,783; F. O. Blake Paving Co., of Chicago, which uses California asphalt, $2.64, 85 cts. and 77 cts., respectively; total, $48,783. The bids of the Western Bermudez Co., the Blake Asphalt Co., of Denver, and Hugh Murphy, of Denver, were rejected as informal. It is stated that Mr. Murphy bid $2.34½ for paving; total, $43,975.

CONCRETE SEWER.—Niagara Falls, N. Y.—W. W. Read, Cy. Engr., informs us that the following bids were received Nov. 29 for constructing 1,425 ft. of 40×60-in. egg-shaped concrete sewer:

| Quantities. | | A. A. Bennett & Co.,[1] $11,187. | Banks & Ingles,[1] $9,616. | A.C. Chenowith,[2] $11,412. | Wm. Franklin,[3] $9,255. | R. D. Young,[1] $10,201. |
|---|---|---|---|---|---|---|
| Sewer, 40 x 60 in., | 1,425 ft. | $6.50 | $5.22 | $5.70 | $5.00 | $5.65 |
| Manholes | 5 | 40.00 | 38.00 | 44.00 | 40.00 | 45.00 |
| Catch basins | 10 | 45.00 | 45.00 | 35.00 | 40.00 | 40.00 |
| Rock | 850 cu. yds. | 1.50 | 1.90 | 3.20 | 1.80 | 1.90 |

[1] Niagara Falls, N.Y. [2] New York, N.Y. [3] 339 Seventh St., Buffalo, N. Y.

STREET LIGHTING.—New York, N. Y.—The following bids were received Dec. 2 for street lighting: Gas.—Equitable Gaslight Co., $12 a year for each lamp; Standard Gas Co., $13.04; Consolidated Gas Co., for the city south of Harlem River and Spuyten Duyvil Creek, at $17.50; Central Gaslight Co., in 23d ward, at $24; Northern Gaslight Co., in 24th ward and part of Westchester, at $28; Yonkers Gaslight Co., part of 24th ward and King's Bridge, at $28. Naphtha.—New York & New Jersey Globe Gaslight Co., in Morrisania, Woodlawn Heights, City Island and Central Park, at $22. Electric lighting.—Brush Electric Co., 720 lamps, at $40 a light; Madison Square Lighting Co., 310 lamps, at $40, and 10 lamps at $50; Mount Morris Electric Lighting Co., 361 lamps, at $40; Harlem Lighting Co., 212 lamps, at $40, and 19 lamps at $50; Manhattan Electric Lighting Co., 241 lamps, at $40; Edison Electric & Illuminating Co., 125 lights at $50; North River Electric Lighting Co., 830 lamps in annexed district, at $45.

### METAL MARKET PRICES.

LEAD.—New York: 3.3 to 3.33 cts. Chicago: 3.05 to 3.07 cts. St. Louis: 3 to 3.05 cts.

BARB WIRE.—Pittsburg: $2.15 to $2.3 for galvanized, and $2 to $2.15 for painted in carload and less than carload lots at mill.

FOUNDRY AND PIG IRON.—New York: $13 to $14.50. Pittsburg: $13 to $14.50. Chicago: $13 to $15.50.

TRACK MATERIAL.—New York: angle bars, 1.45 to 1.55 cts.; spikes, 1.75 to 1.85 cts.; track bolts, 1.95 to 2.05 cts. with square, and 2.1 to 2.15 cts. with hexagon nuts. Chicago: angle bars, 1.65 to 1.8 cts.; spikes, 1.9 to 2 cts.; track bolts, 2.25 to 2.3 cts. with square and 2.45 to 2.5 cts. with hexagon nuts.

NAILS.—Pittsburg: $2.25 per keg for carload lots and $2.35 for less than carload lots, at mill; $2 and $2.05 for cut nails at mill. Chicago: $2.40 and $2.50 for wire nails, $2.17 and $2.25 for cut nails. New York: $2.43 and $2.53 for wire nails, and $2.18 and $2.28 for cut nails.

RAILS.—New York: $28 at eastern mills and $28.75 at tidewater; old rails, $14.50 to $15 for iron, and $12.50 for steel; light rails, $29; girder rails, $26. Pittsburg: $28 for standard sections of 45 lbs. and over; old rails, $16.50 for iron, and $14.50 for steel. Chicago: $29 to $31 for standard sections; $28 for light sections; old rails, $17 for iron, and $11.50 to $12.25 for steel.—English T-rails have been purchased for a California railway, the cheap water rate from England to the Pacific coast making the cost delivered there less than the price of American rails sent on the cars. The cost of English rails at Atlantic ports is about $22, with $7.84 per ton for duty, making the cost delivered about $30 per ton.

STRUCTURAL MATERIAL.—New York: beams, 1.7 to 2.1 cts.; channels, 1.7 to 1.8 cts.; angles, 1.6 to 1.7 cts.; tees, 1.8 to 1.9 cts.; universal mill plates, 1.7 to 1.8 cts.; steel plates, 1.65 to 1.75 cts. for tank, 1.9 to 2 cts. for shell, 2.1 to 2.25 cts. for flange, 2.4 to 2.5 cts. for ordinary firebox, 2.6 to 2.75 cts. for locomotive firebox. Pittsburg: beams, 1.6 to 1.85 cts; channels, 1.6 to 1.85 cts.; angles, 1.4 to 1.5 cts.; tees, 1.6 cts.; Z-bars, 1.6 cts.; universal mill plates, 1.7 to 1.8 cts.; steel plates, 1.6 to 1.7 cts. for tank, 1.7 to 1.75 cts. for shell, 1.8 to 1.85 cts. for flange, 2.5 cts. for ordinary firebox, 2.5 to 4 cts. for locomotive firebox. Chicago: beams, 1.8 to 1.9 cts.; channels, 1.8 to 1.9 cts.; angles, 1.65 to 1.85 cts.; tees, 1.8 to 1.95 cts.; universal mill plates, 1.75 to 1.85 cts.; steel plates, 1.75 to 1.85 cts. for tank, 1.95 to 2.05 cts. for flange, 2.75 to 2.8 cts. for ordinary firebox, 4 to 4.5 cts. for locomotive firebox.

## INDUSTRIAL NOTES.

THE STANDARD WIRE WORKS, of New Castle, Pa., have been purchased by Mr. Jonas Kaufman.

THE CATSKILL SHALE BRICK & PAVING CO., of Hudson, N. Y., has received an order from Albany, N. Y., for 2,500,000 brick.

THE LUNKENHEIMER BRASS WORKS, of Cincinnati, O., reports that its trade with China and Japan is constantly on the increase.

THE McSHANE FOUNDRY CO., of Baltimore, will start up its furnaces at St. Helene, Md., at once, thereby giving employment to 350 men.

THE SAVAGE FIRE BRICK CO., of Washington, D. C., has secured the contract to furnish the District of Columbia with 60,000 invert sewer brick.

THE JOHN H. McGOWEN CO., of Cincinnati, O., has a large contract for hydraulic machinery for a tobacco factory in Australia, according to press reports.

THE KIDD BROS. & BURGHER STEEL CO., of McKee's Rocks, Pa., has commenced operations at its new plant, and will manufacture all kinds of steel wire goods.

THE OTIS STEEL CO., of Cleveland, O., is reported to be about to spend a large sum of money in making improvements, so as to increase the capacity of the works.

RIEHLE BROS. TESTING MACHINE CO., of Philadelphia, Pa., announces that it is about to begin the publication of a quarterly periodical devoted to records of tests.

THE SMEDLEY MFG. CO., of Dubuque, Ia., waterworks contractors and manufacturers of pumps, is reported to have made an assignment; liabilities, $51,000; assets, $70,000.

MR. L. B. CLAY, of Macon, Ga., has a contract for an artesian well, to be sunk at Albany, Ga. It is stated that this is the 219th well that Mr. Clay has contracted for in Georgia alone.

THE STANDARD ELECTRIC CO., of Chicago, Ill., recently presented to the Ohio State University a new regulating apparatus for the 20-light arc dynamo which the company put in a year ago.

THE UNITED STATES CAR CO., of Anniston, Ala., is reported to be about to begin repairs and improvements to its rolling mill, overhaul the car works, and put the entire plant in operation.

THE LAURIE ENGINE CO., of Montreal, has made arrangements with the Linde British Refrigeration Co., of London, England, to manufacture their patent refrigerating machinery for Canada.

THE GRATIOT TELEPHONE CO., of Gratiot, Mich., has authorized its board of directors to secure the requisite funds and extend the line to Alma and St. Louis, and, if thought advisable, as far north as Saginaw.

THE GARDEN CITY FOUNDRY CO., of Chicago, Ill., has succeeded Turner, Dickinson & Co., founders and machinists, and has commenced erecting a building 100×64 ft., which will be used as a machine shop.

LEVERING & GARRIGUES, of New York, N. Y., announce the removal of their office to Nos. 552 and 554 West 23d St., where they will continue to handle contracts for structural and ornamental iron work.

THE UNION MALLEABLE IRON CO., of Moline, Ill., will add another foundry and furnace before the end of the year, increasing the capacity 50%. A complete machine shop is run in connection with the works.

THE EDGAR-THOMPSON FOUNDRY & MACHINE WORKS, of Mobile, Ala., has completed putting in the water-works machinery for the county poor asylum, and the work has been accepted by the county commissioners.

THE DELMARVIA TELEPHONE CO., of Chester, Pa., has organized with Joseph L. Carpenter, Jr., as president, and J. Augustus McCaulley as treasurer. The company intends to build a city and state telephone system early next year.

WILLIAMS, WHITE & CO., of Moline, Ill., recently built for the Sylvan Steel Co. a machine for shearing 4-in. billets. The firm has purchased the right to manufacture the Sandage friction drop hammers, and has already booked several orders.

THE AMERICAN WATER-WORKS CO., of New York, N. Y., is reported as having purchased the plant of the Rife Engine Co., at Roanoke, Va., and it is stated that the offices of the company will be moved to New York. Man., B. L. Greider.

A. J. BEARDSLEY & SON, of Bridgeport, Conn., lost their dredge "Bridgeport" by fire recently. They were engaged in dredging Cos Cob Harbor, under a government contract. The loss amounted to about $20,000, which was fully covered by insurance.

THE NEW CASTLE ASPHALT BLOCK CO., of New Castle, Pa., recently purchased 850 tons of asphalt from Trinidad. The company has contracts for a large amount of asphalt paving in New York state, which will keep it busy some months.

THE ELLIOTT WASHINGTON STEEL CO., of New Castle, Pa., has decided to purchase the ground on which the Fleming Boiler Works are located, and proposes to enlarge its mill for making cold rolled and strip steel, to double its present capacity.

HOFFMAN & AHLERS, of Cincinnati, O., have secured the contract for equipping a large distillery at Terre Haute, Ind., with boilers, cookers, and alcohol apparatus. The company also has a contract for furnishing a distillery outfit in Belfast, Ireland.

RIEHLE BROS. TESTING MACHINE CO., of Philadelphia, Pa., have notified us that they have received a silver medal for the excellence of their 100,000-lb. automatic and autographic testing machine exhibited at the Atlanta Exposition. This, the company states, is the highest award.

THE LUDLOW VALVE CO., of Troy, N. Y., has practically completed negotiations whereby it will occupy the Rensselaer mill of the Troy Steel & Iron Co.'s plant. The firm will take possession next July, and work will be carried on at both plants, the old and the new, and the output will be doubled.

THE INTERNATIONAL ELECTRICAL CO., of Danbury, Conn., has been organized, and holds patents on a new system of electric railway propulsion, invented by John M. Murphy and Albert F. Pierce, of Danbury, Conn., which requires neither overhead wires nor conduit. Mr. Albert F. Pierce, Secy., Danbury, Conn.

THE CHICAGO, MILWAUKEE & ST. PAUL R. R. is having built at its West Milwaukee shops about 1,000 freight cars, to be equipped with iron trucks, automatic couplers and air-brakes. It is stated that the motive power will soon be increased by several new compound locomotives, to be built by the Baldwin Locomotive Works.

THE BUTTE SEWER PIPE & TILE CO., 25 West Granite St., Butte, Mont., has steadily increased its capacity, and now has a large business in the far West. In addition to its pipe and tile works, the company has large brick and lime kilns, and deals in hydraulic cements, plaster, fire brick and clay. Mr. J. G. Hammer is the general manager.

THE SECKNER CONTRACTING CO., Unity Bldg., Chicago, has just begun construction work on the Crown Point (Ind.) water-works; the Fowler (Ind.) water-works were completed Nov. 9; work was started Sept. 10; cost, $37,902.50. The company recently completed a grain elevator at Sheldon, Ill., and will complete the Alexandria (Ind.) water-work in about 10 days.

THE BASIC CITY CHILLED ROLL & IRON WORKS, of Basic City, Va., was recently chartered. The company will manufacture flour-mill machinery, rolling-mill machinery, and products of iron, wood and brass, etc., and will utilize an idle plant at Basic City. Pres. and Treas., D. K. Joslin, of Camden, N. J.; Vice-Pres., C. H. Woodruff, of Philadelphia; Secy., A. E. Fletcher, of Basic City.

THE BETHLEHEM IRON CO., Bethlehem, Pa., report the quick forging of a 22½-in. shaft at their works. The order for this shaft, which was for one of the pumping engines of the Chicago water-works, was received Saturday afternoon, and the finished shaft was shipped the following Wednesday. The shaft was made of fluid compressed high carbon steel, hydraulic forged and annealed.

THE Q. & C. COMPANY, of Chicago, Ill., has issued a circular letter, in which it states that it proposes to protect its rights as the exclusive licensee under the Servis Tie-Plate patents, which, it claims, cover broadly any form of flange or projection on the under side of a tie-plate, so arranged that, when the plate is in position, the flanges or projection will enter the tie longitudinally, or parallel with the grain of the tie.

NEW COMPANIES.—The Schoen Pressed Steel Co., Pittsburg, Pa.; $5,000, with $500 paid in; A. Ross Bassett, Allegheny, Pa.

The Osgood Car Co., Portland, Me.; $2,000,000; Pres. and Treas., Emory F. Chaffee, of Somerville, Mass.

The Segmeister Dust Guard Mfg. Co., Seattle, Wash.; $75,000; J. Sagmeister, N. Hugo Smith and Otto Fuhrman.

Holston Sash & Door Co., Duluth, Minn.; $60,000; David E. Holston, P. C. Quellette, R. M. Hunter, and others, of Duluth.

Toledo Drop Forge Co., Toledo, O.; $30,000; J. M. Ashley, Robinson Locke, Charles S. Ashley, M. I. Wilcox, Wm. Sheridan.

Peter Hostcher Cut Stone & Construction Co., St. Louis, Mo.; $5,000; Peter Hostcher, James Cary, Louis F. Felger and others.

Electric City Brewing Co., Niagara Falls, N. Y.; $125,000; J. S. Macklen, C. F. Hathaway, F. L. Lovelace and A. L. Buell.

Columbian Carbon Co., Williamsport, Pa., $30,000, with $3,000 paid in; to manufacture carbon gas; Treas., N. B. Bubb, Williamsport.

McGeehan Construction Co., Ashland, Wis., $5,000, to construct railways, etc.; J. J. McGeehan, M. J. McGuigan and James T. Gregory.

Hogomoc Iron Co., Duluth, Minn.; $50,000; Pres., Frederick R. Green; Vice-Pres., G. G. Hartley; Secy. and Treas. Herbert L. Hartley.

William R. Knox Machinery Co., St. Louis, Mo.; $10,000; William R. Knox, Alexander G. Gilliman, Benjamin Becktold, all of St. Louis.

Mt. Savage Enamel Brick Co., Mt. Savage, Md.; $75,000; Andrew Ramsey, Hugh A. McMullen and James Findlay, Mt. Savage, and others.

Aluminum Plumber Supply Co., New York, N. Y.; $10,000; T. Milliott, Constant Deerdon, Milton Schanler and X. Herms, of New York city.

Iowa & Dakota Telephone Co., Centerville, S. Dak.; $25,000; J. E. Tomlinson, of Centerville; A. Hotz, of Parker, and W. H. Tottell, of Lemars, Ia.

The New Jersey Aluminum Co., Newark, N. J.; $25,000; J. C. Coleman, Gustave A. Kuellichmidt, of Newark, and Charles P. Peddi, of Westfield, N. J.

Philadelphia Standard Telephone & Telegraph Co., Philadelphia, Pa.; $10,000, with $1,000 paid in; Treas., Richard W. Clay, 2015 Delancey Place, Philadelphia.

The Miller Gas Engine Co., Springfield, O.; $50,000; Charles A. Miller, James A. Hurd, Edward M. Hurd, John L. Zimmerman and Samuel F. McGrew, of Springfield.

The Standard Electric Car & Power Co., Portland, Me.; to develop an electric railway invention; $500,000, with $400 paid in; Pres., John K. Wightham, of Boston, Mass.

Yukon Transportation Co., Seattle, Wash.; to do a general transportation business, build railways, etc.; $250,000; Wm. A. Beddoe, John M. Dumphy and Frank A. Smith.

Kanawha Lumber & Mfg. Co., St. Albans, W. Va.; $50,000; A. B., J. D. and B. L. Lewis, of St. Albans; Thomas J. Slager, Huntington, and G. O. Chilton, of Charleston.

The Albemarle & Chesapeake Towing Co., Norfolk, Va.; $100,000; Pres., Oscar F. Smith; Secy., John T. Gibbs, both of Norfolk, and Franklin Weld, of Falmouth, Mass.

Herman Engineering Co., Cleveland, O.; to manufacture all kinds of machinery; $100,000; Ludwig Herman, Valentine Morris, John P. Cowing, A. F. Brewer and M. H. Martin.

Asphalt Ready Roofing Co., Jersey City, N. J.; $100,000, with $1,500 paid in; Francis A. Stowell, of Jersey City, N. J., and Joseph M. Norcross and Burr W. Banks, of New York city.

Brooklyn Galvanizing & Mfg. Co., Flemington, N. J.; $20,000, with $3,000 paid in; John Foran and Wm. A. Abendroth, of Flemington, N. J., and Edward H. Little, Jr., of Brooklyn, N. Y.

Gas Consumers' Association, Camden, N. J.; $200,000, with $1,000 paid in; C. F. Leavenworth, Washington, D. C.; Andrew B. Kean, Philadelphia, Pa., and Joseph W. Robinson, Jersey City, N. J.

The Hall-Moore Mfg. Co., Cincinnati, O.; to manufacture street car fenders, etc.; $200,000; John Moore, Edmund K. Stallo, F. J. Phillips, C. O. Hall and A. Acton Hall, of Cincinnati, O.

The Woodruff Refrigerating Co., Portland, Me.; to manufacture ice machines, etc.; $100,000, with $30 paid in; Pres., Francis N. Dartt, of Boston, Mass.; Treas., Samuel O. Woodruff, of Boston Mass.

The Nash Mfg. Co., Dixon Ill.; to manufacture b'cycles, sewing machines, etc.; $250,000; John H. Broslus, Terre Haute, Ind.; Thomas C. Nash, Chicago, Ill.; J. N. Newman, of Dixon, Ill., and others.

The Essex Contract & Construction Co., Hoboken, N. J.; $100,000, with $1,000 paid in; Myles Tierney, New York, N. Y.; Alexander S. Niven, Glen Ridge, N. J., and Charles E. Heuberer, Leonia, N. J.

The American Mineral Releasing Co., Portland, Me.; to release minerals from ores, and to manufacture milling machinery; $250,000; Pres., C. S. Haley, of Boston; Treas., S. H. Cochran, of Everett, Mass.

J. F. Stephens Co., Town of Union, N. J.; to erect houses, wharves, docks, vessels, etc.; $50,000, all paid in; James F. Stephens, Hoboken, N. J.; John R. Scott, Jersey City, and J. Milton, of Bayonne City.

Oak Point Improvement Co., Greenwich, Conn.; to drive artesian wells; $2,000, with $1,000 paid in; Oliver L. Ford, Sound Beach, Conn.; J. D. Sawyer, Edward Binney and C. P. Morris, of New York, N. Y.

Delaware County Gas Mfg. Co., Philadelphia, Pa.; to operate at Darby, Jeadon, Sharon Hill, Colwyn, Landsdowne, Swarthmore, etc.; $250,000, with $25,000 paid in; Treas., H. C. Turnbull, Baltimore, Md.

Calcium Carbide Mfg. Co. of Massachusetts, Camden, N. J., and Boston, Mass.; $2,000,000, with $1,000 paid in; Frank M. Lewis and Chas. C. Mickle, of Philadelphia, Pa., and Henry C. Blair, Jr., of Edgewater Park, N. J.

Boston Rotary Engine Co., Portland, Me.; to manufacture engines of all kinds, boilers, machinery, etc.; $250,000, with $300 paid in; Pres., Charles Bullock, Cambridge, Mass.; Treas., W. A. Barbour, Cambridge, Mass.

The Acme Gas, Fuel & Construction Co., Jersey City, N. J.; $100,000, with $1,000 paid in; La Fayette R. Beckley, New York, N. Y.; Wm. Hoffman, John Rooney, Freehold, N. J.; John Loughran and John D. Kelley, of Brooklyn, N. Y.

The Pittsburg & Midway Coal Mining Co., Kansas City, Mo.; $200,000; S. H. Lanegan, Pittsburg, Kan.; T. A. and L. H. Bonebrake, of Topeka, Kan.; W. C. Endsley, Frank Huntoon and A. J. Shirk, of Kansas City, and others.

Clearwater Navigation Co., Lewiston, Idaho; to navigate the Clearwater, Snake and Columbia rivers; $25,000, with $13,000 subscribed; Fred M. Hallett, of Juliaetta; J. H. Brown, of Spokane; and George W. Morrison, of Juliaetta.

The Smith-Ross Co., Jersey City, N. J.; to manufacture and deal in cement, brick, sewer pipe, fire clay, etc.; $25,000, all paid in; Alexander Smith and A. J. Ross, of Jersey City, N. J., and Frederick L. Whritner, of Suffern, N. Y.

Hygeia Ice & Mfg. Co., Woodbury, N. J.; $30,000; Wm. B. Hexamer, of Philadelphia, Pa.; James W. Davis, Clementon; Wm. Martin, of Atlantic City; Charles Walton, Edward C. Leeds and Theodore Burrows, of Woodbury.

The Betts Patent Headlight Co., New York, N. Y.; to manufacture headlights, bicycles, hardware specialties, etc.; $100,000; George B. and G. S. Wilson, of Philadelphia; W. F. Crary, L. F. Betts and Joseph Tripp, of Brooklyn.

The American Machine Co., Cleveland, O.; to manufacture electrical machines, machinery supplies, power and hand motors, etc.; $100,000; Frank Mock, Theodore Rucker, M. D. Williams, Wm. F. Kuler and A. J. Michael, all of Cleveland.

Richardson & Boynton Co., of Dover, N. J.; to manufacture furnaces, ranges, heaters, etc.; $150,000, with $12,000 paid in; Henry T. Richardson, Dwight S. Richardson and Frederick B. Richardson, of Brooklyn, N. Y., and John Anness, of Jersey City, N. J.

Commerce Dispatch Co., Haddonsfield, N. J.; to operate at Indianapolis, Ind.; to purchase, sell, and repair railway equipment of all kinds, etc.; $10,000, all paid in; C. Ford Stevens, Philadelphia, Pa.; Clarence Sill, Darby, N. J.; John McNeill, of Haddonfield, N. J.

The Jump-Off Joe Flume Co., Grant's Pass, Ore.; to construct and operate log and lumber flumes, tramways, chutes and skid roads along Jump-Off-Joe Creek to Merlin, and to purchase lands and do a general lumbering business; $100,000; H. C. Perkins, A. J. Barlow and E. C. Wade.

St. Joseph Railway Light, Heat & Power Co., St. Joseph, Mo.; $3,200,000; W. M. Harrimen, New York city; Camille Weldeford, Oyster Bay, L. I., N. Y.; George D. Patton, Plainfield, N. J.; Alfred Deckers, South Orange, N. J.; R A Brown, W. T. and J. H. Van Brunt, of St. Joseph, Mo.

Automatic Telephone Construction Co., New York, N. Y.; $100,000; Henry N. Whitney, Silas B. Dutcher, James F. Pierce, of Brooklyn; George M. Hard, 192 Broadway, R. T. Wilson, Jr., and Wm. D. Chase, of New York city. John G. Dorrance, of Nyack, and James W. Hinckley, of Poughkeepsie.

Live Wire Cut-Out Co., Jersey City, N. J.; New York, N. Y.; Albany, N. Y.; Boston, Mass.; $250,000, with $5,000 paid in; to manufacture appliances for street railway and electric light purposes; Wm. Kennon Jewett, New York city; Henry K. Wight, Springfield, Mass.; Robt. M. Dixon, East Orange, N. J.

The Lake Submarine Co., Newark, N. J.; to erect buildings, wharves, docks, vessels, etc.; $1,000,000, all paid in; Simon Lake, J. Christopher Lake, of Baltimore, Md.; Somers T. Champion, Atlantic Highlands, N. J.; Wm. R. Hinsdale, Orange, N. J.; Geo. C. Williams, Newark, N. J.; John E. Foster and Henry I. Ely, of Atlantic Highlands, N. J.

## WHAT OTHERS SAY OF US.

We receive many letters from subscribers and others showing that the Construction News department of Engineering News is being more and more appreciated, and that those engineers and city officials who advertise their work in this paper find this the most efficient as well as the most economical method of bringing proposed work to the attention of desired parties.

The following extracts are from letters which have recently been received:

AN INTERESTING DEPARTMENT.

"I enclose several news items for your Construction News columns, which I find a growing and very interesting addition to your journal."

MORE THAN 100 INQUIRIES.

"We received something over 100 inquiries in reply to our advertisement in Engineering News."

CAUSES LIVELY COMPETITION.

"The board was very much pleased with the result of our letting, and attributed the lively competition chiefly to the advertisement published in your largely-circulating paper."

CAUSES TOO MUCH COMPETITION.

"I enclose a notice of letting for building a short extension of our railway. We should have advertised this work in Engineering News, but we did not care to be worried by possibly some 200 contractors writing for specifications and expecting replies. I have been a subscriber to the News off and on for 20 years."

MORE THAN 150 REPLIES.

"We are well satisfied with the result of our water-works letting. Our advertisement in Engineering News brought us more than 150 letters of inquiry, and a large number of low bids."

IT ALWAYS PAYS.

"You will find enclosed a schedule of the bids received for our water-works. The much-to-be-desired competition was secured. The committee admits that it pays to advertise, and it is well pleased with the result of its advertisement in Engineering News."

OUR ADVERTISEMENTS SAVE MONEY.

"We are much pleased with the result of our sewer advertisement, and are sure it saved the city several thousand dollars. As for paving proposals, I am satisfied we should have accomplished nothing if we had not advertised the work in Engineering News."

## SITUATIONS WANTED.

There are hundreds of worthy young men out of employment who read Engineering News. If there is a vacancy in your office, we ask you to avail yourself of our "Want" columns to secure assistants.

## WE WANT.

We want more news from your vicinity. We want more news items in regard to projected work in which you are interested. We want you to consider the advisability of sending us more news items for our Construction News columns.

## A CALIFORNIA BRIDGE.

San Buena Ventura, Cal., Nov. 18, 1895.

Engineering News Publishing Co.,
New York city.

Gentlemen: Enclosed find statement of bids on steel bridge over the Harmon Barranca, Ventura County, Cal. The contract was awarded at $6,864. Our advertisement in the News was entirely satisfactory and was no doubt the means of getting the matter intelligently before the bridge men. In my judgment it pays. All the bidders agree that I have secured for the county the best and cheapest highway bridge on the coast. I enclose $7.60, the cost of the advertisement.

Yours truly,
Geo. C. Powers, County Surveyor.

(There were seven bidders for this work. In our issue of Nov. 21 we published the 12 bids received for a $10,550 bridge at Abbeville, La., also advertised in Engineering News. Nearly every bridge company and prominent bridge contractor in North America reads this paper, and advertisements inserted in its columns are thus given the greatest possible publicity. ALL BRIDGE WORK SHOULD BE ADVERTISED IN ENGINEERING NEWS.—Ed.)

## 22 BIDS; 100 APPLICATIONS.

Champaign, Ill., Nov. 22, 1895.

Engineering News Publishing Co.,
New York city.

Gentlemen: I herewith send you a schedule of the bids received Nov. 15 for constructing a system of sanitary sewers for our city. We received 22 bids and are well pleased with the result of our advertisement in the News. More than 100 applications for specifications were received and a majority of those writing stated that they saw our advertisement in your paper.

Yours truly,
C. J. Strahle, City Clerk.

## Result of a FURNITURE Advertisement.

Fairfax, Va., Nov. 12, 1895.

Engineering News Publishing Co.,
New York City.

Gentlemen: Enclosed find check for our advertisement for furnishing the new county and circuit court clerk's offices with the necessary furniture and fixtures. The publication of this in Engineering News brought me about 15 letters and 3 bids. We feel that the advertisement paid us.

Yours truly,
F. W. Richardson, County Clerk.

(We have received hundreds of letters showing that our water-works, sewer, paving, electric light, public building, railway, etc., advertisements produce extensive competition from reliable contractors, and that a short advertisement in this paper is positively the most efficient as well as the most economical method of securing desirable competition for supplies or construction. The letter printed above is additional evidence that contract work of all kinds should be advertised in Engineering News, and that IT ALWAYS PAYS TO ADVERTISE WORK IN THIS PAPER.—Ed.)

The Circulation of Engineering News among Prominent Contractors and Contractors' Supply Men Probably Exceeds that of Any Other Five Papers in America.
ADVERTISE YOUR WORK WHERE IT IS GIVEN THE GREATEST POSSIBLE PUBLICITY.